U.S. Army Corps
of Engineers

Galveston District
Southwestern Division

Corpus Christi Ship Channel, Texas
Channel Improvement Project

Volume I

Final Feasibility Report
and
Final Environmental Impact Statement

April 2003

DEPARTMENT OF THE ARMY
GALVESTON DISTRICT, CORPS OF ENGINEERS
P.O. BOX 1229
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REPLY TO
ATTENTION OF

Corpus Christi Ship Channel, Texas

Channel Improvement Project

Feasibility Report

April 2003

Syllabus

This report makes recommendations for authorizing improvements to the Corpus Christi Ship Channel (CCSC) and La Quinta Channel projects in Texas. The study responds to a congressional resolution adopted August 1, 1990, by the Committee on Public Works and Transportation, U.S. House of Representatives. The Port of Corpus Christi Authority is the non-Federal sponsor for the navigation improvements and the environmental restoration components.

The results of these studies show that channel improvements to include widening and deepening of the CCSC, extending the La Quinta Channel, and construction of barge lanes flanking the upper bay portion of the CCSC, along with the proposed placement plan recommended in this report, to be the plan that maximizes net economic benefits, consistent with the Administration's policy for protecting the Nation's environment.

In response to the desires of the Sponsor, State, and resource agencies for using the dredged materials for beneficial uses and the Federal policy for environmental restoration, the plan recommended for implementation in this report consists of navigation improvements and environmental restoration improvements. Based on the economic, engineering, and environmental factors considered, the navigation portion of the selected plan includes deepening of the CCSC from Viola Basin in the Inner Harbor to the end of the jetties in the Gulf of Mexico to 52 feet, deepening of the remainder of the channel into the Gulf of Mexico to 54 feet, widening of the Upper Bay and Lower Bay reaches to 530 feet, construction of parallel, 12 feet deep, barge shelves across the Upper Bay portion of the CCSC, and extending the La Quinta Channel approximately 7,400 feet at a depth of 39 feet. Dredged material management incorporates the use of existing placement areas, as well as newly designated placement areas including several beneficial use (BU) sites. BU sites will be constructed to create several hundred acres of shallow water habitat throughout the bay system. New work dredging will create approximately 41 million cubic yards of material, while it is estimated that maintenance over the 50-year period of economic evaluation will generate approximately 208 million cubic yards of material. The environmental restoration portion of the Selected Plan consists of the construction of an offshore breakwater and a shoreline revetment to protect and enhance existing habitat.

The different components of the selected plan were evaluated for impacts to tide, salinity, and current. Modeling of these parameters suggests insignificant changes in the ranges of these parameters, during both wet and dry periods.

The widening and deepening of the CCSC will generate annual benefits of $32,607,000 with annual costs of $12,858,000, producing a benefit-cost ratio of 2.5. The creation of the barge

shelves in the Upper Bay portion of the CCSC will have annual costs of $86,600 and annual benefits of $134,000, and a benefit-cost ratio of 1.5. Annual benefits produced by the extension of the La Quinta Channel will be $9,264,500 while annual costs will be $5,138,000, generating a benefit-cost ratio of 1.8. The project benefits presented in this report are for a 2006-2056 period of economic evaluation and are based on a Federal Discount (FY) 2003 rate of 5 7/8 percent and Fiscal Year 2000 vessel operating costs.

The Project Cost of all project components, minus inflation and interest during construction, totals $138,594,000. The NED Investment Cost of all components, totals $245,306,000, and includes $19,299,000 in interest during construction for project components, $26,031,000 in deep-draft utility relocation costs, $5,022,000 in removal costs, $49,672,500 in bulkhead and berthing modification costs, and $6,688,000 in interest during construction for associated activities. Total average annual costs for the project are $18,083,000. Fully Funded Cost of the projects, which includes Project Costs and expected escalation totals, is $150,302,000.

Project costs for navigation and environmental restoration will be allocated according to the cost sharing provisions in the Water Resources Development Act of 1986, as amended. Based on these provisions and calculated in current dollars, $73,687,000 will be apportioned to the Federal Government, while $146,146,000 will be non-Federal expenditures.

The recommended navigation improvements maximize National Economic Development benefits and the recommended environmental restoration improvements optimize habitat outputs based on incremental cost principles. The requirements of Section 404(r) of Public Law 92-500, as amended, have been met.

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I. INTRODUCTION

The Corpus Christi Ship Channel (CCSC) provides deep-water access from the Gulf of Mexico to the Port of Corpus Christi, via Aransas Pass, through Redfish Bay and Corpus Christi Bay. Access points include the La Quinta Channel, the Gulf Intracoastal Waterway (GIWW), and the Rincon Canal. The 1969 Rivers and Harbors Act changed this project, formerly known as the Port Aransas-Corpus Christi Waterway, Texas, to the Corpus Christi Ship Channel, Texas. This Act was a consolidation of old improvements in Port Aransas, Texas, and channel improvements from Aransas Pass to Corpus Christi, Texas. Aransas Pass connects Corpus Christi Bay with the Gulf of Mexico. The waterway extends from deep water in the Gulf through the Aransas Pass jettied entrance, then westerly 20.75 miles to and including a turning basin at Corpus Christi, then westerly 1.75 miles through Industrial Canal to and including a turning basin at Avery Point, then westerly 0.9 miles to and including the Chemical Turning Basin, then 3.3 miles to and including a turning basin near Tule Lake, then northwesterly 1.8 miles to the Viola Turning Basin. The La Quinta Channel extends off of the CCSC near Ingleside, Texas, and runs parallel to the eastern shoreline of Corpus Christi Bay for 5.5 miles to the La Quinta Turning Basin (Figure 1).

The existing authorized depth for both the CCSC and the La Quinta Channel is 45 feet. Project width of the CCSC ranges from 700 feet in the entrance channel to 200 feet at locations in the Inner Harbor. The La Quinta Channel measures 300 to 400 feet wide. Construction of the existing 45-foot project on both the Corpus Christi and La Quinta Channels was completed in 1989.

The size of ships has steadily increased such that vessels have to be light-loaded to traverse the waterway. The current channel depth requires that large crude carriers remain offshore and transfer their cargo into smaller crude tankers for the remainder of the voyage.

This comprehensive navigation study investigates the feasibility of improving the CCSC and La Quinta Channel. This section of the report identifies the study authority, scope, participants and coordination, related studies, and study process. The study area is shown on Figure 1. A series of 13 plates attached to this report details the entire project in plan view. Any project component not specifically detailed by figure in the report can be viewed in those plates.

PURPOSE AND AUTHORITY

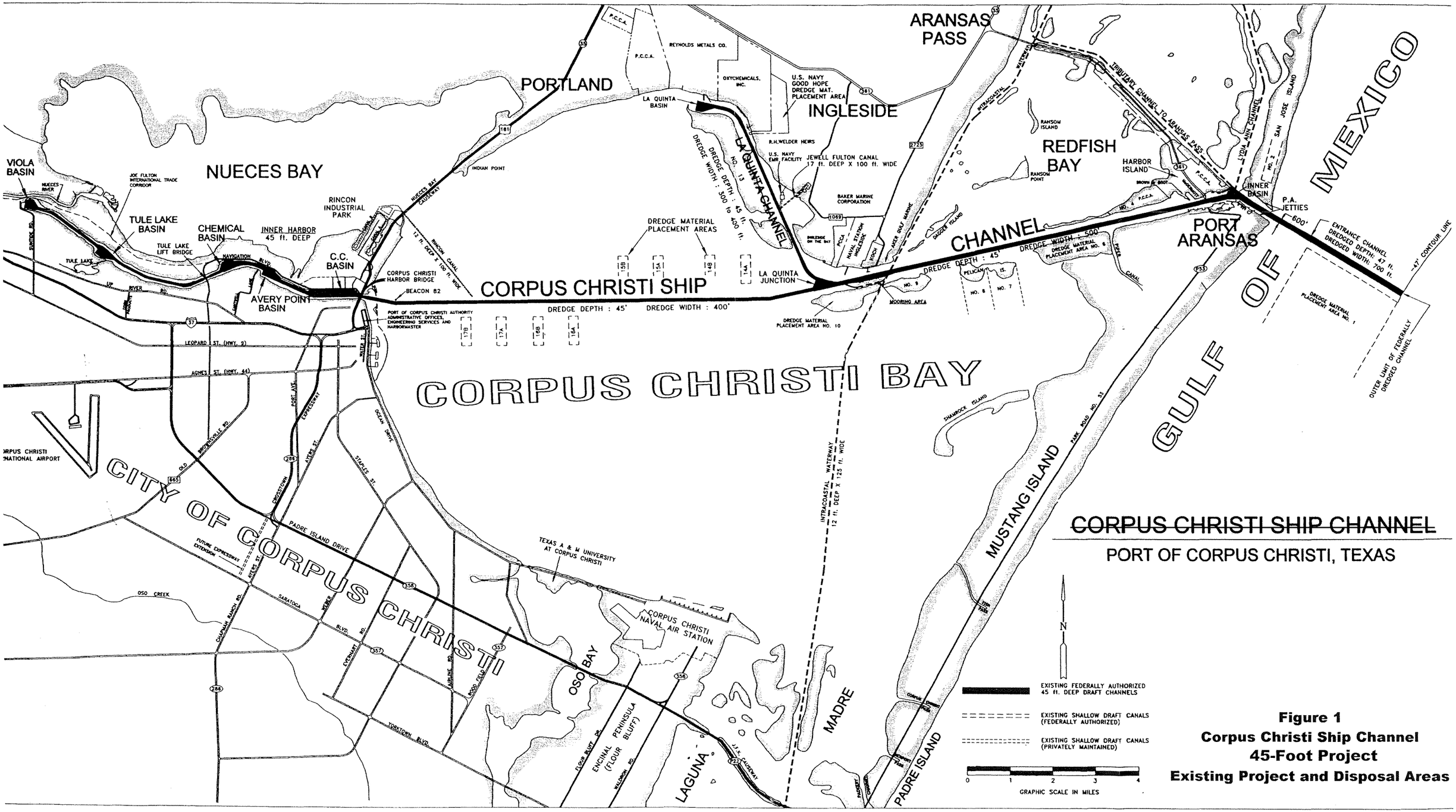
The purpose of this study is to develop and evaluate alternatives for navigation problems that directly affect the CCSC and La Quinta Channel within the Corpus Christi Bay system. To allow for a more effective, safe, and efficient waterway, the study is focused on eliminating the major problems contributing to inefficiencies on the waterway, such as insufficient depth and width, as determined by fleet forecasts, the requirement for one-way traffic in portions of the channel, and the need for safe barge shelves. The study also identifies new economic benefits associated with proposed channel modifications and recommends alternatives that maximize these benefits.

This feasibility study is being conducted to determine if an improved navigation project is in the Federal interest and to provide the documentation needed to recommend Congressional authorization and funding for construction of that project. The study responds to a congressional resolution adopted August 1, 1990, by the Committee on Public Works and Transportation, U.S. House of Representatives. The resolution reads:

> Resolved by the Committee on Public Works and Transportation of the United States House of Representatives, That the Board of Engineers for Rivers and harbors, is requested to review the reports on the Port Aransas-Corpus Christi Ship Channel, Texas (45-Foot Project) published as House Document 99, 90th Congress, Second Session, and other pertinent reports to determine the feasibility of modifying the Corpus Christi Ship Channel, with particular emphasis on the La Quinta Channel and on Harbor Island, in the interest of commercial navigation and related purposes."

DESCRIPTION OF THE STUDY AREA

The CCSC is located in Corpus Christi Bay on the southern portion of the Texas coast, 180 miles southwest of Galveston and 132 miles north of the mouth of the Rio Grande. The project study area is situated in Nueces and San Patricio Counties.



CORPUS CHRISTI SHIP CHANNEL

PORT OF CORPUS CHRISTI, TEXAS

Figure 1
Corpus Christi Ship Channel
45-Foot Project
Existing Project and Disposal Areas

Physiography

Corpus Christi Bay is a large, shallow body of water about 14 miles long oriented in a northeast-southwest direction and is about 12 miles wide at its widest part. Mustang Island separates Corpus Christi Bay from the Gulf of Mexico on the east. Redfish Bay to the northeast, Nueces Bay to the west, and Oso Bay to the south are smaller arms of the main embayment. Laguna Madre, a narrow coastal bay, extends southward from Corpus Christi Bay. The Nueces River with its tributaries, the Frio and Atascosa Rivers, is the prime source of freshwater to the Corpus Christi Bay system. The entrance channel for the CCSC is the primary outlet from Corpus Christi Bay to the Gulf of Mexico that maintains water circulation and provides a migratory route for fish and crustaceans. Corpus Christi Pass, Newport Pass, and Packery Channel are historic natural passes located near the southern end of Mustang Island. These inlets as well as the man-made Fish Pass are open only for a short time following a hurricane or tropical storm. The mean diurnal tide variation in the Corpus Christi Bay system is about 0.7 feet. This variation can be significantly modified by winds from cold fronts in winter and tropical storms in the summer season.

The study area is located on the coastal prairies physiographic region of the Texas Coastal Plain. Land elevation in the area ranges from about 150 feet above sea level in northwestern Nueces County to sea level along Corpus Christi Bay, but the shoreline has been cut back by wave action to form steep cliffs, ranging in height from 15 to 35 feet along the southern and western shorelines of the bay. Most of the area lies on the nearly level coastal plain, while a much smaller area is composed of tidal flats and barrier islands. Area soils are generally sandy or clay loams. A saline clay is present in the coastal plain areas and fine to medium grained sand is found in the tidal flats and barrier island areas.

Geologic units of the study area consist of Pleistocene age sediments of the Beaumont Formation and Recent age sediments of bay, barrier island, and alluvial deposits. The Inner Harbor portion of the CCSC was originally excavated along the south side of Nueces Bay. Nueces Bay is the drowned Nueces River Valley that was flooded during the last few thousand years by a rise in sea level. The original valley had been eroded to an average elevation of about -45 feet mean low tide, and in some points down to –100, before being drowned. The bay has since been substantially filled with soft recent deposits transported by the Nueces River and by material eroded from the bay shore.

Climate

The climate of the CCSC area is humid subtropical with warm to hot summers and mild winters. The dominant air mass in summer is marine tropical in which sea breezes moderate afternoon heat. Occasional showers or thunderstorms are common during this season. Winters are mild with considerable day-to-day variation between the marine tropical air mass and modified continental polar and marine polar air masses. Periods of freezing temperatures are infrequent and usually last no longer than two or three days.

Rainfall averages about 29 inches annually at Corpus Christi. The annual rainfall distribution is greater for the early summer and fall periods and least for the winter and late summer. Two principal wind regimes dominate the area and include persistent, southeasterly winds occurring from March through November and strong, short-lived northerly winds from December through February. Severe weather occurs periodically in the area in the form of thunderstorms, tornadoes, and tropical storms or hurricanes.

Fish and Wildlife Resources

The CCSC study area contains estuarine, upland, and wetland areas that support a varied population of fish and wildlife resources. The area contains an abundance of game and non-game wildlife resources. The area also supports a productive sport and commercial fishery and provides recreational opportunities that are intensively utilized during the year.

Aquatic Resources

Aquatic resources in the project area include the open waters of Nueces and Corpus Christi Bays, tidal flats and channels, and freshwater ponds in the Nueces River delta. Nueces Bay and Nueces River delta are considered integral parts of the overall Nueces-Corpus Christi Bay ecosystem. Corpus Christi Bay is one of the deepest bays along the Texas coast with natural depths of 11 to 13 feet. Nueces Bay has a 2- to 6-foot range of water depths, with an average depth of 3 feet. Bottom sediment types in Nueces and Corpus Christi Bays include sand, silts, and clays of varying proportions. Salinities in the bays range from fresh conditions during periods of heavy rainfall or river flooding to hypersaline conditions (greater than 40 parts per thousand) during prolonged drought.

The lower food chain in Nueces and Corpus Christi Bays consists of phytoplankton, zooplankton, and benthic organisms. The metabolism of the Nueces-Corpus Christi Bay ecosystem is based primarily on phytoplankton and zooplankton. Benthic organisms are the largest and most diverse group of organisms inhabiting the Nueces-Corpus Christi Bay estuary

system. Benthic populations in Nueces Bay have been classified as river-influenced assemblages where turbidity is relatively high and salinity normally at reduced levels. Benthic organisms in the bay system include polychaetes, mollusks, and arthropods.

The Nueces and Corpus Christi Bay estuarine areas provide important nursery and feeding habitat for numerous species of sport and commercial fish and shellfish. Common commercial and sport species of fish in Nueces Bay include black drum, red drum, menhaden, spot , Atlantic croaker, spotted seatrout, and, southern flounder.

Important commercial crustaceans occurring in the Nueces-Corpus Christi Bay system include brown and white shrimp, and blue crab. Nueces Bay is a prime nursery area for white shrimp. A major portion of Nueces Bay has been designated a shrimp nursery area and closed to shrimping by the State of Texas. Reefs and scattered areas of the American oyster occur in Nueces and Corpus Christi Bays.

The Corpus Christi Bay system is a productive and very important estuarine system to the Texas commercial fishery. This system has ranked high in total production of seafood products among the Texas bay systems. The project area receives heavy recreational fishing use throughout the year. Sport fishing activities in the area are particularly heavy during the seasonal runs of flounder, spotted seatrout, red drum, and black drum.

Terrestrial Resources

Upland habitat types occurring in the project study area include pasture, brushland, Gulf cordgrass, cropland, and existing vegetated placement areas (PAs). These habitats support a diverse population of wildlife species. About 50 species of terrestrial mammals have been documented in the general study area. Mammals occurring in upland areas include rabbits, rats, raccoons, coyotes, mice, fox, and white-tailed deer. The brushland area probably contains the greatest diversity and abundance of mammals. Pasture and Gulf cordgrass are grazed by cattle and are also inhabited by small mammals and various passerine birds. Lands in Nueces and San Patricio Counties used as cropland have sparse ground cover and provide poor quality habitat for wildlife. Over 50 species of reptiles and about 20 species of amphibians inhabit the general study area.

Wetland Resources

Wetland vegetation important in the Corpus Christi-Nueces Bay area include seagrasses and intertidal and fresh-water marshes. Seagrasses presently occur along the northeast (Redfish Bay) and southwest (Laguna Madre) margins of the bay system. The seagrasses develop in shallow,

clear waters along the bay margins. Tidal marshes are present on portions of the mainland shoreline and the bay side of the barrier islands and peninsulas. Marsh habitats also occur in the Nueces River delta and along the south shore of Nueces Bay. The Nueces River delta contains tidal and freshwater marshes and is a large and diverse area of high value to fish and wildlife. Marsh habitats include sea oxeye marsh, low marsh, freshwater marsh, saltflat grass marsh, and mud flats. High biological productivity is an important feature of marshes since they contribute substantial amounts of biomass and nutrients to the estuarine food chain. Tidal marshes also serve as nursery areas for various species of finfish and shellfish and for numerous shore and wading birds.

Threatened And Endangered Species

There are several species that may occur in the project study area that are listed by the U.S. Fish and Wildlife Service and National Marine Fisheries Service as threatened and endangered. They are protected under provisions of the Endangered Species Act of 1973, as amended.

The brown pelican occurs in the vicinity of the Upper Bay portion of the ship channel. One of the major nesting colonies on the Texas coast, Brown Pelican Island, is an emergent bank of dredged material in Corpus Christi Bay south of the CCSC. Brown Pelican Island contains a primary brown pelican nesting area in a mound at the northeastern corner of the island. Pelicans usually nest in this area between 1 March and 30 August. The arctic peregrine falcon is a migrant that moves through the area in spring and fall. The piping plover is also a migrant that can be found along the Texas coast from fall through spring.

Five species of sea turtle have been reported along the Texas coast, including the Kemp's ridley, loggerhead, green, hawksbill, and leatherback. All species of sea turtles on the National Marine Fisheries Service list might occur in Corpus Christi Bay; however, there are no known aggregation sites or important feeding areas in the immediate project vicinity.

The following species are on the State of Texas Protected Nongame list (equivalent to threatened) and occur in the project area: reddish egret, white-faced ibis, wood stork, least tern, Texas tortoise, and Texas horned lizard.

Cultural Resources

Potentially significant archeological and historic sites have been documented in the Corpus Christi study area. Limited cultural resource investigations in the Corpus Christi area have revealed cultural remains from Paleo-Indian to Historic times. Common aboriginal remains include burial sites and shell middens represented by Archaic Aransas phase and Late Prehistoric

Rockport phase materials. Aboriginal sites are found in great concentration along the bluff north of Nueces and Corpus Christi Bays and their minor tributaries. Erosion, urban and industrial development, and agricultural practices have affected many of these sites. Remains of early Spanish, Mexican, and Anglo-American activities and settlements are also present in the Corpus Christi area.

Socioeconomic Considerations

The CCSC project area lies within Bureau of Economic Analysis Economic Area 143, a 17-county area that includes such cities as Corpus Christi, Laredo, and Kingsville. The economy of the Corpus Christi area is broadly based in manufacturing, agriculture, military, and fishing. The development of improved port transportation facilities along the CCSC has allowed greater export of agricultural products. The Port of Corpus Christi handles large volumes of commodities including crude petroleum and petroleum products, aluminum ores, and agricultural products. Industrial development in the area consists of plants devoted to processing agricultural products, producing and refining petroleum and petroleum products, petrochemicals, and chemical derivatives; manufacturing; fishing and offshore service vessels; drilling rigs; offshore producing platforms; offshore service equipment; and reducing ores to produce aluminum, zinc, and chrome products. The discovery of oil and natural gas in the area promoted a broad industrial base and aided in the development of industries such as oil refining, chemicals, and primary metals, which also rely on port facilities.

The Corpus Christi area is a popular recreational area, and tourism is an important aspect of the local economy. Tourists and retired people are attracted to the area, which is the gateway to the Padre Island National Seashore and other area public and private recreational facilities, the Gulf of Mexico, and nearby lakes. Fishing, boating, and other water related activities are very popular, and both Corpus Christi and Port Aransas have fairly large sport fishing fleets. The diversity of coastal habitats in the Corpus Christi area supports a large diversity of shore birds, while the large number of adjacent shallow bays and grain fields create an ideal habitat for waterfowl. This situation provides for moderate hunting of waterfowl and a large amount of bird watching in the Corpus Christi area.

Nueces and San Patricio Counties lie in the Coastal Bend region of Texas. Land use within this two-county region is divided principally among agricultural land, range-pasture land, industrial land, urban-residential and urban-commercial land, recreational land, park and recreational facilities, military installations, and marshlands. Water use includes mineral production, commercial and sport fishing, recreation, and transportation. Several factors have contributed to this diversified land and water use. This area has a high population concentration. It is an area endowed with extensive mineral resources that support major petroleum refining and

petrochemical processing. Also, it is an area with fertile and productive lands that support extensive agricultural uses. Finally, it contains major port facilities that have led to a high volume flow of imports and exports.

Nueces County has an area of 1,166 square miles with a 1990 population of 291,145 persons. This represents an increase of 8.5% over the 1980 population of 268,215. Total employment consists of a work force of 121,837 with 8.5 percent unemployed in 1990. The 1980 employment figure is 114,780 resulting in a growth rate of 6.1% over the 10-year period. Nueces County has a diversified economy, which includes petroleum processing and production, agriculture, tourism, coastal shipping, manufacturing, and a military complex located in the County. The largest family income group belongs to the range between $35,000 and $49,999. Family median income is $29,177.

San Patricio County is 707 square miles in area with a 1990 population of 58,749 persons. This represents an increase of 1.3% over the 1980 population. Total employment consists of a work force of 22,339 with 2,281 unemployed in 1990. The 1980 employment figure is 22,189 resulting in a growth rate of less than 1 percent over the 10-year period. San Patricio County is also a diversified economy, which includes an oil center, a petrochemicals center, agribusinesses, and a manufacturing complex located in the County. The largest family income group belongs to the range between $15,000 and $24,999. Family median income is $25,607.

PROJECT AREA DESCRIPTION

The authorized Federal navigation project consists of channels and turning basins suitable for oceangoing vessels, and associated rubble-stone jetties. Two project channels, the Corpus Christi Ship Channel and La Quinta Channel, were evaluated in this study. The Corpus Christi Ship Channel begins in deep water in the Gulf of Mexico about 3 miles offshore, passes through the jettied inlet, and extends about 21 miles westward to Corpus Christi. The project is geographically divided into four segments; the Entrance Channel, Lower Bay and Upper Bay reaches, and the Inner Harbor.

The Gulf of Mexico and the Inner Basin bound the Entrance Channel. The jetties that protect the Entrance Channel are 11,190 and 8,610 feet long and extend into the Gulf from San Jose (formerly St. Joseph's) and Mustang Islands, respectively, and stabilize the natural inlet at Aransas Pass.

The Lower and Upper Bay reaches extend west from the Inner Basin to the Harbor Bridge, and are separated by the La Quinta Channel junction. These two reaches differ in that the Lower Bay reach is largely landlocked while the Upper Bay segment is located in the center of the bay with

no adjacent islands or protective structures (Figure 1). Continuing west from the Harbor Bridge, the channel extends about 8.5 miles through the Inner Harbor area before terminating at the Viola Turning Basin. The Inner Harbor is entirely landlocked and is the location of the majority of port facilities. The channel connects a series of turning basins, including the Corpus Christi, Avery Point, Chemical, Tule Lake, and Viola Basins. Access in the Inner Harbor can be restrictive due to two bridges that cross the channel; the Harbor Bridge, a large fixed span bridge at the entrance to the Inner Harbor, and the Tule Lake Lift Bridge located midway to the Viola Turning Basin.

The La Quinta Channel extends from the Corpus Christi Ship Channel at the La Quinta Junction (Figure 1) adjacent to Ingleside Point, which is about half-way between the Gulf of Mexico and Corpus Christi. The La Quinta Channel measures approximately 5.5 miles and currently ends in the La Quinta Turning Basin. This channel is protected from large stretches of open water by the mainland and existing PAs adjacent to the channel.

Initial estimates showed that approximately 70 pipelines cross the existing channels, and further evaluation was necessary to refine that number and determine which lines would need to be moved, should a widening or deepening project be recommended.

The existing project dimensions are shown in Table 1.

Available PA's are located throughout the project area and include upland contained, partially contained, and dispersive sites. Several upland contained sites are available in the Lower Bay, Inner Harbor, and La Quinta Channel. These include Mustang Island (PA 6), PA 10, and PA 4 in the Lower Bay, PA 13 adjacent to the La Quinta Channel, and several Inner Harbor Placement Areas (IH-PA's) including Suntide (IH-PA 8), Tule Lake (IH-PA 6), South Shore (IH-PA 3), Rincon (IH-PA 2), IH-PA 1, IH-PA 4, and IH-PA 5.

Two partially contained sites are located in the Entrance Channel and Lower Bay portion of the project. These are located on San Jose Island (PA 2) and on the south side of the CCSC, west of Port Aransas (PA 5).

Several uncontained sites are also available along the channel. Dredged Material Placement Area (DMPA) 1 is located near the channel in the Gulf of Mexico. PA's 7 and 8, also known as Pelican Island has been used for the beneficial placement of material in the past to maintain this high quality bird habitat. PA's 14A, 14B, 15A, 15B, 16A, 16B, 17A, 17B, and 18 are located adjacent to the CCSC in the Upper Bay reach.

Table 1
Corpus Christi Ship Channel Dimensions

CHANNEL SEGMENT	DEPTH (ft)	WIDTH (ft)	LENGTH (mi)
Entrance Channel			
Aransas Pass Outer Bar Channel	47	600-700	2.8
Aransas Pass Jetty Channel	45-47	600	1.3
Inner Basin at Harbor Island	45	600-1559	0.6
Lower Bay Reach			
Inner Basin Main Channel	45	600	0.6
Humble Basin to Junction at La Quinta Channel	45	500-600	10.0
Upper Bay Reach			
La Quinta Junction to Beacon 82	45	400	9.7
Inner Harbor			
Beacon 82 to Corpus Christi Turning Basin	45	300-400	0.9
Corpus Christi Turning Basin	45	300-800	1.2
Industrial Canal	45	400	0.6
Avery Point Turning Basin	45	400-975	0.5
Tule Lake Channel	45	200-400	3.8
Chemical Turning Basin	45	400-1200	0.5
Tule Lake Turning Basin	45	300-1200	0.4
Viola Channel	45	200-300	1.7
Viola Turning Basin	45	700-900	0.3
La Quinta Channel			
Channel to La Quinta	45	300-400	5.5
La Quinta Turning Basin	45	1200	0.4

NON-FEDERAL SPONSOR AND COORDINATION

The District Engineer, Galveston District, U.S. Army Corps of Engineers (USACE), is responsible for the overall management of the study and report preparation. The Port of Corpus Christi Authority is the non-Federal sponsor for the study. The study is being coordinated with

interested Federal, State, and local agencies, and the public. The following are some of the agencies and groups that provided input during preparation of the report:

Federal Agencies

- U.S. Fish and Wildlife Service
- U.S. National Marine Fisheries Service
- U.S. Environmental Protection Agency
- U.S. Coast Guard

State Agencies

- Texas Commission on Environmental Quality
- Texas General Land Office
- Texas Parks and Wildlife Department
- State Historic Preservation Officer
- Texas Department of Transportation
- Texas Railroad Commission

Regional, County, and Local Agencies

- Port of Corpus Christi Authority

Other Interests

- Coastal Bend Bays and Estuaries Program
- Aransas – Corpus Christi Pilots

A Regulatory Agency Coordination Team (RACT), made up of representatives from many of these agencies, was established to provide guidance on matters relating to the evaluation of environmental impacts of this project. Several technical workgroups, composed of members of the RACT, were established to focus on specific, environmentally related issues of the project.

In addition, representatives of numerous firms involved in navigation as well as special interest groups and individuals provided input to the study.

PRIOR AUTHORIZATIONS

The initial Federal involvement in navigation improvements in the Corpus Christi Bay area began with the Rivers and Harbors Act of June 18, 1878. This authorization provided for the first survey and cost estimates for the channel improvements. The Rivers and Harbors Act of March 3, 1879 authorized the first improvements. This authorization provided for deepening the channel across the outer bar of Aransas Pass to 12 feet and the protection of the head of Mustang Island up to and beyond Turtle Cove. This work was completed in April 1885.

The 1899 Rivers and Harbors Act authorized the acquisition of the north jetty that had been constructed by private interests. Significant improvements on the CCSC began in earnest with the passing of the Rivers and Harbors Act of 1910. The following is a summary by date of authorization of the major improvements that have been made to the Channel and vicinity.

June 1910 - 12-foot X 100-foot channel through Turtle Cove Channel and Corpus Christi Bay, between Aransas Pass and Corpus Christi.

September 1922 - 25-foot X 200-foot from Port Aransas through Turtle Cove to the shoreline near Corpus Christi.

July 1930 - 30-foot X 200-foot with passing lanes from Port Aransas through Turtle Cove to the east side of the Corpus Christi breakwater.

August 1935 - 32-foot channel from Port Aransas to and including a 1000-foot x 3000-foot turning basin at Corpus Christi. An industrial canal 30-foot x 150-foot and an 800-foot x 1200-foot turning basin at Avery Point.

June 1938 - The main turning basin at Corpus Christi was extended 2,500 feet west at 32-foot.

June 1938 - Deepening the Industrial Canal and turning basin to 32 feet and extend the canal 32-foot X 150-foot westward along Nueces Bay shore to a turning basin 32-foot X 900-foot X 1,000-foot near Tule Lake.

March 1945 - 34-foot depth in all project channels and basins, 250-foot width from Port Aransas to breakwater at Corpus Christi, 200-foot width in Industrial Canal and the channel between Avery Point and Tule Lake turning basins, and widen Avery Point turning basin to 1,000 feet.

June 1948 - 38-foot depth from the Gulf to the outer end of the jetty; 38-foot decreasing to 36-foot to station 90 on the north jetty; and 36-foot in all other channels and basins except the

2,000-foot undredged part of the inner basin at Harbor Island, and 400-foot width in the channel from Port Aransas to the maneuvering basin at Corpus Christi.

September 1954 - The La Quinta Channel, 32-foot X 150-foot and a turning basin 32-foot X 800-foot in the vicinity of La Quinta.

July 1958 - The La Quinta Channel to 36-foot X 200-foot. The turning basin to 36-foot X 800-foot X 1,000-foot. The channel entrance was flared and curves were widened. Entrance Channel to 42-foot from the Gulf to the outer end of the jetty; 40-foot in all other channels and basins except the undredged northward extension to the inner basin at Harbor Island and the La Quinta Channel; the Industrial Channel to 400-foot width with flared entrances to Corpus Christi and Avery Point turning basins; a channel 40-foot X 200-foot extending 2.2 miles from Tule Lake turning basin to a turning basin 40-foot X 700-900-foot X 1,000-foot at Viola.

August 1968 - 45-foot depth in existing channels and basins, a deep-draft turning point, a deep-draft mooring area and mooring facilities, and widening of the channels and basins at certain locations. The Act also deauthorized the undredged northward extension of the Inner Basin at Harbor Island and the undredged west turnout (Wye connection) between the La Quinta Channel and the main channel of the waterway.

STUDY AND REPORT PROCESS

In September 1994, the Galveston District completed a Reconnaissance Report for the CCSC. This report concluded that channel modifications that would improve the efficiency and safety of the channels appeared feasible. The report recommended detailed studies to quantify the magnitude of the costs and benefits associated with several types of improvements.

This feasibility study follows the recommendations given in the Reconnaissance Report. It includes detailed analyses of a range of improvements and their effectiveness at improving efficiency and safety by allowing the use of larger, more efficient vessels and reducing delays and vessel casualties. It also includes detailed assessments of environmental, social, and local economic effects of those improvements determined to be most viable from a national economic perspective. Results of this study form the basis for a decision on project implementation, including preconstruction design studies.

The study process provided for a systematic preparation and evaluation of alternate plans which address study area problems and opportunities. The process involved all of the six functional planning steps:

Specify Problems and Opportunities
Inventory and Forecast Conditions
Formulate Alternative Plans
Evaluate Effects of Alternative Plans
Compare Alternative Plans
Select Recommended Plan

The earlier Reconnaissance Report emphasized problem identification and formulation of alternatives. Emphasis in this Feasibility Report is on evaluation of alternatives, assessment of impacts, and selection of a recommended plan.

II. PROBLEM IDENTIFICATION

Existing water resources problems and needs in Corpus Christi Bay were identified through coordination with Federal and State agencies, area residents, waterway users, and the non-Federal sponsor. Most of the identified problems are not unique to Corpus Christi Bay but are common to many of the bays and estuaries in Texas.

NAVIGATION AND COMMERCE

The CCSC was the first waterway in Texas to be completed to a depth of 45 feet. This channel ranks fifth in the Nation for tonnage shipped on deep-draft vessels, and in Texas only the Houston Ship Channel handles more tonnage. Since the completion of the 45-foot project, the size of ships using the waterway has steadily increased so that many vessels currently have to be light-loaded to traverse the waterway. The percentage of total 1998 tonnage shipped in vessels that could be loaded to depth greater than 45 feet was 22 percent. Exclusion of barge tonnage would increase the percentage of draft restricted tonnage to 27 percent.

The Upper Bay segment is only 400 feet wide and is subject to strong cross winds and currents, while the Lower Bay reach is 500 feet wide and is semi-protected by emergent dredged material PAs. As part of the 45-foot project, a mooring area was constructed near Ingleside. This facility consists of six breasting structures and ten mooring structures. It was designed to hold inbound ships at Ingleside while other large ships were crossing the open water area from the Harbor Bridge to Ingleside. This facility has not functioned as designed and is in disrepair. Shippers would rather wait offshore and time their entrance so that passing occurs in the 500-foot reach rather than go through the trouble and expense to get tug assistance to moor and wait with a pilot on board and tugs standing by to release them from the moorings. The Galveston District is currently evaluating removal of these structures. Widening the Upper Bay reach would increase the safety factor for this area and would reduce the shipping delays for the project, especially since shipping trends indicate a movement toward the use of larger vessels. The ultimate size of vessels using the channel is restricted by the 138-foot vertical clearance of both the Harbor Bridge and the Tule Lake Lift Bridge. However, the clearance is sufficient to accommodate the present fleet of vessels using the project.

The current channel depth requires that large crude carriers remain offshore and transfer their cargo into smaller crude tankers for the remainder of the voyage. This lightering operation takes place in the Gulf of Mexico where the two ships, the mother ship and the lightering ship, come together so that the cargo transfer can take place. Although this operation has been going on for

years, the possibility for a collision, oil spill, fire, or other adverse environmental consequences is always present. Deepening the channel will reduce the number of lightering operations.

Current projections suggest that crude imports will increase throughout the life of the project. As the imports increase, the number of lightering vessels and product carriers will also increase, adding to the shipping delays and congestion. Since the most frequent shipping accidents result from collisions between ships and inland tows, the towing industry and channel industries are concerned that restrictions may be placed on the tows to limit these costly and environmentally damaging events.

The approximately 111 commercial terminals are isolated in two areas, specifically the Inner Harbor and La Quinta Channel. Barge terminals make up a large number of these facilities and barge traffic must compete with ship traffic in the CCSC and La Quinta Channel.

No deep-water access exists from the end of the existing La Quinta Channel to the proposed container terminal. Extension of the channel would allow benefits to be achieved while enhancing the economy of the region.

The remaining capacity of the current upland PAs as well as the continued suitability of bay PAs has been examined and a bay-wide plan for the future needs was developed that encourages the use of dredged material for beneficial uses.

Shoreline erosion is occurring along the ship channel in the Port Aransas area. Ship wakes may be contributing to this problem, and resolution of the erosion problem was requested to be included in this study.

The Tule Lake Lift Bridge is a concern because the channel width in this reach restricts ship movements. The lift bridge in this area allows limited access, however, there are considerations being given to removal and/or replacement of this bridge.

ENVIRONMENTAL

Many of the problems such as pollution are caused by anthropogenic activities around the bay system and in the contributing watershed while others such as shoreline erosion are both a result of anthropogenic activities, e.g., shipping, and natural processes including normal wind-generated waves and hurricanes. The environmental concerns identified during the reconnaissance study included the following items.

The increasing potential for environmental harm as a result of shipping accidents is a major concern. In the absence of adequate channel widening, one-way traffic versus two-way traffic should be considered as a means to reduce this threat.

Oil spill recovery and defining the liabilities associated with the clean-up are important to both the environmental community and the oil shipping business. This understanding is necessary to assure that the clean-up activities are started immediately and are completed as quickly as possible to limit the damages. However, response to spills would not change based on modifications to the width or depth of the channels in the region. Because of this, spill recovery is considered outside the scope of this study and further analysis is not necessary.

Sediment quality in the Inner Harbor is a concern and needs to be evaluated.

The ship channel and PAs in the bay have impacts on circulation and salinity levels within the bay. In addition, open bay placement presents potential problems for the benthic community, circulation, shrimping, and the need for redredging.

There are several areas of concern that could possibly be addressed from channel modification or mitigation of the unavoidable impacts. Water interchange between Corpus Christi Bay and the Laguna Madre could be improved, specifically in the vicinity of the Kennedy Causeway and the GIWW. Other potential opportunities include construction of oyster reefs in and around the Corpus Christi area, enhancement of Redfish Bay, and development of bird rookery islands in Nueces Bay.

PROBLEM SUMMARY

The depth and width of the existing channel system remains restrictive due to the size of the current world fleet in operation. Beam width restrictions continue to cause delays for larger ships wishing to enter Corpus Christi's port facilities. Increased channel depths would reduce the need for lightering and lightening. Access to additional facilities would also allow the Port of Corpus Christi to utilize facilities for future development. A project addressing shipping delays while increasing safety for both the industry and the environment is needed.

III. FORMULATION OBJECTIVES, CONSTRAINTS, AND CRITERIA

NATIONAL OBJECTIVES

The fundamental national objective of Federal participation in water resources development projects is to assure that an optimum contribution is made to the welfare of all people. The Water Resources Council's Economic and Environmental Principles and Guidelines for Water and Related Land Resources Implementation Studies dated March 1983 and the National Environmental Policy Act of 1969 (NEPA) provide the basis for Federal policy for planning Federal water resources projects. These authorities have established the procedures for formulation and evaluation of water resources projects. Additional policies and regulations, derived from executive and legislative authority, further define the criteria for assessment of plan impacts, risk analysis, review and coordination procedures, and project implementation.

Current Federal policy dictates that National Economic Development (NED) is the primary national objective in water resources planning. NED objectives stress increasing the value of the Nation's output of goods and services and improving economic efficiency on a national level. Planning objectives designed to improve NED are concerned with the value of increased output of goods and services resulting from external economics associated with a plan.

The Federal objective of water and related land resources planning is to contribute to NED in a manner that is consistent with protecting the Nation's environment. Consequently, the resource's condition should be more desirable with the selected plan than under the without-project condition.

National objectives are designed to assure systematic interdisciplinary planning, assessment, and evaluation of plans addressing natural, cultural, and environmental concerns, which will be responsive to Federal laws and regulations. In addition to the selected NED plan, the proposed project includes environmental restoration features that will protect and enhance valuable habitat identified during the study.

PLANNING OBJECTIVES

The primary objective of Federal navigation activities is to contribute to the Nation's economy while protecting the Nation's environmental resources in accordance with existing laws, regulation, and executive orders. More specific planning objectives were identified by area residents and concerned State and Federal agencies or suggested by existing opportunities for

improving the quality of life. Plans were formulated and evaluated with the following objectives in mind:

1) To improve the efficiency and safety of the deep-draft navigation system, and

2) To maintain or enhance the quality of the area's coastal and estuarine resources.

PLANNING CONSTRAINTS

Plans must be formulated with regard to addressing the problems and needs of the area, taking into consideration future without-project conditions. The plans should identify tangible and intangible benefits and costs from economic, environmental, social, and regional perspectives. Institutional implementation constraints should also be identified. The formulation framework requires the systematic preparation and evaluation of alternative solutions to the recognized water resource-related problems within the study area. The process also requires that impacts of the proposed action be measured and results displayed or accounted for in terms of contributions to: NED, Environmental Quality, Regional Economic Development, and Other Social Effects.

Interaction with other interests must be maintained throughout the planning process to avoid duplication of effort, minimize conflicts, obtain consistency, and assure completeness. The following constraints apply to this feasibility study:

- Fish and wildlife habitat affected by a project plan should be preserved, if possible;
- The study process and plans developed must comply with Federal laws and policies; and
- Alternative plans that resolve problems in one area should not create or amplify problems in other areas.

Current guidance specifies that the Federal objective of planning is to contribute to NED consistent with protecting the Nation's environment. The following general criteria are applicable to all water resource studies. They have generally guided the formulation of this study. Technical, economic, environmental, and social criteria have been established to guide the project development process. These criteria are discussed below.

TECHNICAL CRITERIA

Technical criteria require the preservation of adequate project dimensions to provide safe passage of commercial navigation traffic through this reach of the waterway while minimizing environmental impacts. These criteria require plans to be compatible with navigation needs and consistent with the requirements of the navigational equipment using this portion of the waterway and to provide a long-term plan for the placement of dredged materials in order to continue maintenance of the waterway in the future. These plans must be consistent with specific environmental conditions of the area including soil conditions, topography, and terrestrial and aquatic ecosystems. Formulation of alternative alignments, and dredged material placement alternatives and their evaluation was accomplished by analysis of historical and projected shoaling rates, erosion causes and rates, and general structural and non-structural alternatives applicable for conditions which are specific to this area. Technical information, both historical data and specific information prepared for this project, used during this study included, but was not limited to, salinity model data, ship simulation results, aerial photography, historical dredging records, and previously published scientific reports related to this area.

ECONOMIC CRITERIA

The economic criteria require that tangible benefits attributable to projects exceed project costs. Project benefits and costs are reduced to average annual equivalent values and related in a ratio of benefits to costs (Benefits-to-Cost ratio or BCR). This ratio must exceed unity to meet the NED objective. Selected plans, whether structural, nonstructural, or a combination of both, should maximize excess benefits over costs; however, unquantifiable features must be addressed subjectively. These criteria are used to develop plans that achieve the objective of NED and provide a base condition for consideration of economically unquantifiable factors which may impact on project proposals.

All structural and nonstructural measures for navigation projects should be evaluated using the appropriate period of analysis and the currently applicable interest rate. Total annual costs should include amounts for operation, maintenance, major replacements, and mitigation, as well as amortization and interest on the investment.

ENVIRONMENTAL CRITERIA

The general environmental criteria for navigation projects are identified in Federal environmental statutes, executive orders, and planning guidelines. It is the national policy that fish and wildlife resource conservation be given equal consideration with other study purposes in the formulation and evaluation of alternative plans. The basic guidance during planning studies

is to assure that care is taken to preserve and protect significant ecological, aesthetic, and cultural values, and to conserve natural resources. These efforts also should provide the means to maintain and restore, as applicable, the desirable qualities of the human and natural environment. Alternative plans formulated to improve navigation should avoid damaging the environment to the extent practicable and contain measures to minimize or mitigate unavoidable environmental damages. Particular emphasis was placed on the following:

- Protection, preservation, and improvement of the existing fish and wildlife resources along with the protection and preservation of estuaries and wetland habitats and water quality;

- Consideration in the project design of the least disruptive construction techniques and methods;

- Mitigation for project-related unavoidable impacts by minimizing, rectifying, reducing or eliminating, compensating, replacing, or substituting resources;

- Preservation of significant historical and archeological resources through avoidance of effects. This is the preferable action to any other form of mitigation since these are finite, non-renewable resources.

SOCIAL AND OTHER CRITERIA

Plans proposed for implementation should have an overall favorable impact on the social well-being of affected interests, and have overall public acceptance. Structural and nonstructural alternatives must reflect close coordination with interested Federal and State agencies and the affected public. The effects of these measures on the environment must be carefully identified and compared with technical, economic, and social considerations and evaluated in light of public input.

PLAN FORMULATION RATIONALE

The rationale for formulating and developing alternative solutions is discussed in the following paragraphs. The planning framework requires the systematic preparation and evaluation of alternative ways of addressing problems, needs, concerns, and opportunities while considering environmental factors. The criteria and broad planning objectives previously identified form the basis for subsequent plan formulation, screening, and ultimately plan selection.

The planning process for this study has been driven by the overall objective of developing a comprehensive plan that would allow safe, two-way barge and ship traffic along the CCSC. Secondary objectives have been to address other related water resources problems in the study area. The first phase of this process was to establish the magnitude and extent of the problems and then to develop and evaluate an array of alternative solutions to meet the existing and long-range future needs of the area.

During the feasibility phase, lines of communications were opened with Federal, State, and local agencies, private groups, and the affected public. Through scoping and other coordination meetings, public involvement activities were continued throughout the planning process.

The expected future without-project scenario was first developed for comparison with other alternatives. Nonstructural and structural plans were developed to address the planning objectives. For the structural plans, an array of channel modifications and dredged material placement alternatives were developed, evaluated, and screened. The modifications were investigated as to possible means to satisfy the objectives of a safer, more efficient CCSC.

Through a two-phased screening process, a plan was ultimately selected. A long-term dredged material placement plan was also developed for the selected plan. Further preliminary design refinements were accomplished for the selected plan prior to developing a baseline cost estimate for this plan.

IV. PLAN FORMULATION

WITHOUT PROJECT CONDITION/NO ACTION

The USACE planning guidance requires analysis of a "without" project plan as one of the alternatives. Also, to comply with the requirements of the NEPA, a "no action" plan must be included in the alternative array. The "without project" plan is synonymous with the No Action Plan. The "without project" plan also forms the basis against which all other alternative plans are measured.

The Without Project Condition would retain a 45-foot deep navigation channel with its periodic maintenance dredging program. Use of the channel by multiple vessels would be limited because of the current 400-foot width of the Upper Bay portion of the channel. As vessels increase in draft and beam, the restrictive depth and width of the CCSC would prevent some vessels from entering with full loads, or prevent the use of the channel complex altogether by large vessels. This need for lightering and light loading would increase costs and decrease efficient use of vessels wishing to use the port facilities.

NON-STRUCTURAL MEASURES

One non-structural opportunity available is the continued use of beam width restrictions within the channel. Current restrictions prevent two ships with a total beam width greater than 251 feet from passing in the channel. This alternative would only maintain current operations, with increased costs and delays. Another non-structural measure is use of lightering and lightening vessels. This is another practice already in use and would offer no additional benefits. Therefore, non-structural alternatives were not considered feasible or did not fully address the problems.

STRUCTURAL MEASURES

Structural alternatives considered include dredging to widen and deepen the existing CCSC and the La Quinta Channel as well as an extension of the La Quinta Channel. This alternative allows existing ships to more fully utilize the proposed channel. It also creates a situation where ships can avoid delays due to the ability to meet more safely in a wider channel. However, dredging creates the need for the placement of dredged material. Any plan considered should ensure that placement alternatives address the needed capacities as well as the need to ensure minimal impacts to the environment. Because structural alternatives address all of these needs, the alternatives considered were all of a structural nature.

Potential structural restrictions exist at both the Harbor Bridge and Tule Lake Lift Bridge. These structures have set clearance requirements and may prevent ships of a certain size from entering the Inner Harbor portion of the channel. However, the vertical clearance of the bridge is sufficient to accommodate the present fleet of vessels using the project. The project deepening is not forecasted to result in the introduction of larger vessels; thus, none of the benefits identified are for vessels that cannot currently pass under either bridge. The Tule Lake Lift Bridge may be removed or replaced; however, this may occur under both the without and with project future. The Texas Department of Transportation (TxDOT) has been funded to study the Harbor Bridge replacement. The TxDOT selected an engineering group last year to perform the study. Proposed channel improvements will not affect the foundations of the existing bridges.

V. PLAN ASSESSMENT AND SCREENING OF ALTERNATIVES

The ultimate objective of the feasibility study is to arrive at a selected plan after a full range of alternatives has been analyzed. This involves a comparison between each alternative and the future without-project condition consequences, considering economic, environmental, and social impacts.

SCREENING PROCESS

A general screening process was first used to determine which structural plan would result in the objective of providing safe and efficient navigation at the least cost while minimizing environmental impacts. A total of 23 alternatives were initially evaluated for more detailed consideration. These alternatives included:

- Widening only across Corpus Christi Bay with no deepening (1 alternative).
- Deepening to 48, 50, or 52 feet from the Gulf of Mexico to the Viola Turning Basin, without widening and with widening to 470, 500, or 530 only across the Upper Bay portion of the channel (12 alternatives).
- Each of the widening alternatives would include barge shelves on each side of the channel (1 alternative).
- Deepening the La Quinta Channel to 48, 50, and 52 feet with and without the La Quinta Channel extension (3 alternatives).
- Extending the La Quinta Channel at depths of 36, 38, 40, 42, and 45 feet (5 alternatives).
- No Action Plan (1 alternative).

Benefits and costs, detailed in Table 2, were developed for all of these alternatives. These numbers were used to reduce the number of alternatives to be considered during more detailed evaluation. Mitigation was not considered when screening alternatives, but was given due consideration during development of the selected plan. Cost factors such as levee construction, dredging, and pipeline relocations/removals were included in this cost analysis. The evaluation was performed to put all the alternatives on an equal basis without the mitigation costs. Costs were developed for all of the alternatives; however, benefits were determined only on certain alternatives.

Table 2
Initial Costs and Benefits for All Considered Alternatives

Corpus Christi Ship Channel Widening and Deepening					
Depth (ft)	Width (ft)	Benefits ($000)	Cost ($000)	BCR	Net Benefits ($000)
45	500	650	1,024	0.6	-374
48	400	37,855	6,567	5.8	31,288
48	470	--	7,519	--	*
48	500	38,505	7,821	4.9	30,683
48	530	--	8,056	--	*
50	400	49,758	7,834	6.4	41,924
50	470	--	8,847	--	*
50	500	50,408	9,075	5.6	41,333
50	530	--	9,375	--	*
52	400	60,483	9,168	6.6	51,316
52	470	--	10,248	--	*
52	500	61,133	10,553	5.8	50,581
52	530	--	11,088	--	*
La Quinta Channel Deepening					
Depth (ft)	Width (ft)	Benefits ($000)	Cost ($000)	BCR	Net Benefits ($000)
48	300	482	847	0.57	-365
50	300	702	887	0.79	-184
52	300	702	888	0.79	-186
La Quinta Channel Extension					
Depth (ft)	Width (ft)	Benefits ($000)	Cost ($000)	BCR	Net Benefits ($000)
36	300	8,979	1,549	5.80	7,430
38	300	9,245	1,598	5.78	7,648
40	300	9,280	1,604	5.79	7,676
42	300	9,253	1,658	5.58	7,595
45	300	9,159	1,760	5.20	7,398
Barge Shelves					
Depth (ft)	Width (ft)	Benefits ($000)	Cost ($000)	BCR	Net Benefits ($000)
12	200	133	81	1.64	52

* Benefits were not computed for these widths because the ship simulation study was used to determine the preferred width of the channel. It was not necessary to compute a BCR for each depth and width combination, but only to determine the best depth alternative for a common width.

From the analysis of the 23 alternatives, six alternatives were selected for further consideration. These alternatives included:

- Deepen to 50 and 52 feet from the Gulf of Mexico to the Viola Turning Basin and widen across Corpus Christi Bay (based on net benefits and safety reasons).
- Widen only across Corpus Christi Bay (non-Federal sponsor requested).
- Deepen the La Quinta Channel to 50 feet (non-Federal sponsor requested).
- Extension of the La Quinta Channel.
- Construction of barge shelves across the Upper Bay portion of the CCSC.

A detailed analysis of benefits and costs was performed for each of these six alternatives. This information is detailed in the following sections and is then used in selection of the plan.

VI. ECONOMIC EVALUATION

The project benefits were calculated based on reductions in transportation costs. The initial screening showed that a channel depth of 52 feet produced the highest net excess benefits for the deepening plans evaluated for the main channel. The screening analysis suggested that additional studies were necessary to conclude if widening of the bay reach and extension of the La Quinta channel were in the Federal interest. In addition, deepening the La Quinta Channel beyond the existing project depth of 45 feet was also investigated. The non-Federal sponsor and pilots association expressed a strong interest in widening of the bay reach due to safety concerns and associated vessel delays and self-imposed vessel meeting restrictions. The recommendation for widening the entire bay reach to 530 feet was based on the Engineer Research and Development Center (ERDC) findings and the safety interest of Aransas-Corpus Christi Pilots. The pilots presently limit vessel meetings to combined beam width up to 251 feet in the 400-foot reach and a combined loaded draft limit of 80 feet.

The project benefits are for a 2006-2056 economic evaluation period and are based on the FY 2002 Federal Discount rate of 6 1/8 percent and FY 2000 vessel operating costs (Economics Guidance Memo (EGM) 00-06). Vessel operating costs for tow vessels were obtained from EGM 00-05 FY 2000. A 1998-99 base was generally presented in the cost savings tables. Data from 1999 and 2000 were incorporated into tables and the effect that more recent years had on the commodity forecasts were evaluated. In general, the commodity forecasts were developed based on multiple-regression equations, which incorporated data for the most recent 20 to 30 year period.

CHANNEL DEEPENING BENEFITS

Channel deepening benefits were calculated for Corpus Christi crude petroleum, petroleum products, and grain cargoes.

The transportation costs and the savings associated with the proposed project depth increases were calculated using commodity specific vessel class and trade route distributions. Transportation costs were calculated based on the channel depth alternatives and variables associated with vessel design drafts, maximum feet of light-loading, underkeel clearance, mileage traveled, and the number of hours to load and unload. Maximum vessel cargo capacities for crude oil, petroleum products, and grain were estimated using a range of load factors obtained from Institute for Water Resources Report 91-R-13, National Economic Development Procedures Manual Deep-Draft Navigation, November 1991.

Crude Petroleum Imports

Reductions in the vessel operating costs for Corpus Christi's foreign crude petroleum imports were calculated based on the difference in transportation costs between the without project and with project conditions. Transportation costs and savings were calculated for crude petroleum import tonnages using the fleet distributions detailed in the Economic Appendix.

Methods of shipping crude oil are direct, lightered, lightened, and transshipped. Direct shipment, as the name implies is the transfer of tonnage by vessel between two coastal ports. Direct shipment savings were calculated for several project alternatives and are summarized in Table 3. Lightering involves the transfer of tonnage at an offshore location from a larger vessel, called a VLCC (Very Large Crude Carrier), onto one or more shuttle vessels. With lightering, the VLCC does not enter the coastal receiving port. Transshipping occurs at one of several Caribbean port locations, and like lightering, it involves the full discharge of a VLCC. The advantage of transshipping is that vessel turnaround is faster than with lightering; however, the frequency of transshipping has decreased in recent years due to its relative high cost in comparison to lightering. The current percentage of transshipped tonnage is very small in comparison to lightering. A frequent alternative to either direct shipment or lightering is lightening. The term lightening describes the process where enough cargo is offloaded from a tanker to permit the light-loaded vessel to enter a confined channel system. The format of the Waterborne Commerce Statistic Center's (WCSC) shipping records, which are obtained through the Bureau of Census, do not provide sufficient information to distinguish lightened tonnage from direct or lightered tonnage. Thus, combined lightering and lightening savings are summarized in Table 4. Industry personnel and additional Bureau of Census and pilot's records indicated that lightening is common for shipments from Africa and Europe. Savings for both shipment methods are summarized in Table 5.

Foreign Petroleum Product Tonnage

Transportation savings benefits were calculated for Corpus Christi petroleum product import and export tonnage. Benefits were calculated for 30 percent of 2005-56 petroleum product imports and 10 percent of export tonnage. The percentage of future petroleum product movements expected to benefit from channel depths over 45 feet was identified based on examination of vessel sizes, vessel loads, foreign port depths associated with Corpus Christi's 1996-99 petroleum product imports and exports, and the Department of Energy's (DOE) U.S. and World Fleet Forecast's (WFF) U.S. Gulf Coast product trade forecasts.

Table 3

Crude Petroleum Annual Transportation Savings for Direct Shipments

	47	48	49	50	52
2000	$2,257,163	$3,271,087	$4,188,573	$5,106,059	$7,040,872
2006	$2,018,980	$2,925,169	$3,744,842	$4,564,515	$6,288,782
2016	$2,444,723	$3,541,981	$4,534,475	$5,526,968	$7,614,673
2026	$2,727,517	$3,951,248	$5,057,939	$6,164,630	$8,489,931
2036	$2,935,802	$4,252,063	$5,442,032	$6,632,000	$9,126,974
2046	$3,205,114	$4,641,226	$5,939,154	$7,237,081	$9,953,239
2056	$3,542,153	$5,128,419	$6,561,673	$7,994,927	$10,989,290
2006-56 @ 5.875%	$2,575,791	$3,731,409	$4,776,485	$5,821,561	$8,017,177

Table 4

Crude Petroleum Annual Transportation Savings for Lightered & Lightened Shipments

	47	48	49	50	52
2000	$32,117	$112,825	$164,218	$215,611	$215,611
2006	$27,802	$126,711	$188,356	$250,000	$250,000
2016	$33,852	$200,702	$303,179	$405,655	$405,655
2026	$36,318	$228,628	$346,428	$464,228	$464,228
2036	$36,057	$236,741	$359,458	$482,175	$482,175
2046	$36,395	$246,397	$374,657	$502,916	$502,916
2056	$37,341	$257,557	$391,959	$526,361	$526,361
2006-56 @ 5.875%	$34,084	$199,142	$300,587	$402,032	$402,032

Table 5

Crude Petroleum Transportation Savings Summary

	47	48	49	50	52
2000	$2,289,280	$3,383,912	$4,352,791	$5,321,671	$7,256,483
2006	$2,046,782	$3,051,880	$3,933,197	$4,814,515	$6,538,781
2016	$2,478,575	$3,742,684	$4,837,654	$5,932,624	$8,020,328
2026	$2,763,835	$4,179,875	$5,404,367	$6,628,858	$8,954,159
2036	$2,971,859	$4,488,804	$5,801,490	$7,114,175	$9,609,149
2046	$3,241,509	$4,887,623	$6,313,811	$7,739,998	$10,456,155
2056	$3,579,494	$5,385,976	$6,953,632	$8,521,288	$11,515,651
Equivalent Annual Savings	$2,609,875	$3,930,551	$5,077,072	$6,223,593	$8,419,209

The vessel sizes and port depths associated with Corpus Christi's 1996-99 product imports showed that 20 percent of imports were shipped in vessels with design drafts over 50 feet and 33 percent of imports were shipped from ports with depths in excess of 50 feet. Examination of

vessel sizes and trade route data showed that 6 percent of existing products export tonnage was shipped in vessels with design drafts in excess of 45 feet and 4 percent of tonnage was shipped to foreign ports with depths in excess of 50 feet. Application of the trade route forecasts to Corpus Christi showed that 10 percent of 2006-56 products export tonnage could benefit from a project depth in excess of 45 feet. For the 50-foot channel, this percentage would decrease to 7 percent and to 6 percent for the 52-foot project.

After identifying the percentage range of tonnage constrained by the current 45-foot project depth, the trade routes associated with these movements were evaluated in relationship to the DOE and WFF trade route forecasts. Examination of Corpus Christi's 1996-99 routings showed that tonnage associated with larger vessels moving to deepwater ports is primarily associated with Northern Europe and the Persian Gulf. The DOE and WFF forecasts show that refined product import and export trade between the U.S. regions and Northern Europe and Persian Gulf locations will continue for the period 2006 to 2020, and 2006 to 2050, respectively. The Corpus Christi share was estimated based on the assumption that percentage of these draft-constrained movements would continue to move through U.S. Gulf Coast ports. The WFF U.S. Gulf Coast 1998/99 to 2050 projections show increasing volumes of tonnage moving in large vessels. Tables 6 and 7 display the transportation cost savings for petroleum product import and export tonnage.

Table 6

Petroleum Product Imports Annual Transportation Savings

	47	48	49	50	52
2000	$3,145,596	$4,699,240	$5,866,269	$7,535,441	$9,487,142
2006	$3,353,952	$5,009,693	$6,257,142	$8,036,137	$10,130,004
2016	$5,788,140	$7,719,089	$10,111,294	$12,783,391	$17,553,898
2026	$8,253,453	$11,614,614	$14,989,776	$18,764,746	$25,695,217
2036	$11,564,306	$16,304,365	$21,029,747	$26,321,849	$36,013,210
2046	$15,949,079	$22,517,821	$29,031,079	$36,332,645	$49,678,841
2056	$21,831,743	$30,837,682	$39,751,544	$49,747,544	$68,007,299
Equivalent Annual Savings	$7,361,546	$10,302,120	$13,284,971	$16,731,076	$22,669,722

Bulk Grain Exports

The annual transportation savings for bulk grain transportation associated with the proposed channel deepening alternatives are presented in Table 8. Examination of 1996-99 Corpus Christi grain exports indicated that 7.5 percent of 1996-99 tonnage was shipped in vessels that could be loaded to depths over 45 feet. This percentage was based on actual tonnage shipped in vessels with loaded drafts between 41 and 45 feet; tonnage shipped in vessels with loaded drafts over 50

feet; and channel depth at the port of destination. The project benefits were calculated based on an estimated 12 percent of tonnage being transported in vessels with loaded drafts in excess of 45 feet. The percentage of future grain export tonnage expected to benefit from channel depths over 45 feet was based on vessel sizes, vessel loads, and foreign port depths.

Table 7

Petroleum Product Exports Transportation Savings

	47	48	49	50	52
2000	$65,383	$103,328	$110,475	$117,230	$129,686
2006	$162,776	$257,242	$275,035	$291,851	$322,861
2016	$204,117	$327,386	$360,133	$391,102	$448,250
2026	$221,696	$355,581	$391,149	$424,784	$486,855
2036	$240,766	$386,168	$424,795	$461,324	$528,733
2046	$261,513	$419,445	$461,400	$501,077	$574,295
2056	$284,061	$455,611	$501,184	$544,281	$623,812
Equivalent Annual Savings	$211,116	$337,525	$369,036	$398,833	$453,813

Table 8

Grain Exports Annual Transportation Savings

	47	48	49	50	52
2000	$66,035	$82,573	$98,150	$105,473	$111,041
2006	$89,554	$111,982	$133,108	$143,038	$150,590
2016	$131,547	$164,492	$195,523	$210,109	$221,203
2026	$152,242	$190,370	$226,283	$243,164	$256,003
2036	$188,139	$235,257	$279,638	$300,499	$316,365
2046	$264,448	$330,677	$393,059	$422,382	$444,683
2056	$274,909	$343,757	$408,607	$439,090	$462,273
Equivalent Annual Savings	$145,145	$181,495	$215,734	$231,828	$244,068

Channel Deepening Benefit Summary

Savings identified for all transportation commodity types are combined to identify benefits for channel deepening. Table 9 displays a summary of the project deepening benefits. The 52-foot channel depth provides the greatest equivalent annual transportation cost savings.

CHANNEL WIDENING BENEFITS

Benefits were calculated for widening the Corpus Christi Bay Channel 400- and 500-foot reaches to 530 feet. The benefits associated with widening the bay reach to 530 feet were calculated based on the probability of vessel meetings and potential delays. The Aransas-Corpus Christi Pilots vessel meeting criteria is that vessels with combined beam widths of 251 feet or more cannot meet in the 400-foot reach. An additional criterion is that meetings are not permitted between vessels with combined loaded drafts in excess of 80 feet. The pilots noted that the 80-foot combined draft limit was invoked in the early 1990's. The 45-foot channel deepening project became operational in the late 1980's and at that time, crude oil tankers with loaded drafts up to 45 feet mean low water (MLW) were not uncommon. Presently, few crude oil vessels are loaded to more than 41 feet. Examination of the vessel records showed that some petroleum coke vessels are presently loaded to depths up to 45 feet MLW. The pilots said that they would allow dry cargo, such as petroleum coke, to be loaded to deeper depths than liquid cargo. The general policy is that vessels should have 3 feet of underkeel clearance. Examination of 1996-99 transit records showed that loaded drafts over 41 feet are infrequent, particularly for liquid cargo. Comparison of 1990 traffic data with recent traffic data showed that 1-foot of underkeel clearance or less was not uncommon for liquid cargoes during the early 1990's.

Table 9

Corpus Christi Main Channel Deepening Benefits by Commodity

Channel Depth Alternative

Commodity	47	48	49	50	52
Crude Oil imports	$2,609,875	$3,930,551	$5,077,072	$6,223,593	$8,419,209
Product imports	$7,361,546	$10,302,120	$13,284,971	$16,731,076	$22,669,722
Product exports	$211,116	$337,525	$369,036	$398,833	$453,813
Bulk grain exports	$145,145	$181,495	$215,734	$231,828	$244,068
Equivalent Annual Savings	$10,327,682	$14,751,691	$18,946,813	$23,585,330	$31,786,812

Benefits for widening the bay reach were calculated based on reductions in delays due to the combined beam width restriction. Benefits were not calculated for easement of the underkeel clearance policy as the pilots indicated that there would not be a change in the policy to maintain 3 feet of underkeel clearance.

The interview and log data were used to formulate probability distributions that incorporated the range of delay times obtained from the interviews. The project benefits were based on reductions in delays presently incurred due to the channel dimensions. The projected annual

reduction in delay costs is summarized in Table 10. Total vessel trips were projected to increase at an average annual rate of 1 percent for the period 2000 through 2056 and the rate of growth for draft restricted vessels was projected to increase at an annual rate of 2 percent between 2000-26 and by 1 percent for the remainder of the period of economic evaluation (Economic Appendix pp. 26-30, 38, and 44).

Table 10

Corpus Christi Ship Channel, Annual Deep-Draft Vessel Widening Benefits

Delays Due to Combined Beam and Draft Restrictions, and Tug Availability

Year	Annual One-Way Trips	Hourly Cost	Annual Trips Delayed	Annual Delay Cost
2000	1,084	$1,205	100	$243,856
2006	1,197	$1,205	122	$258,287
2016	1,323	$1,205	149	$395,293
2026	1,461	$1,205	181	$481,859
2036	1,614	$1,205	200	$532,273
2046	1,783	$1,205	221	$587,960
2056	1,969	$1,205	244	$649,474
Equivalent Annual Benefits				$417,660

In addition to beam width delays, the pilots stated that channel widening and deepening would likely result in bay transit time savings of 6 to 20 minutes for all vessels with beam widths over 80 feet. The pilots noted that these time savings would occur for the entire 25-mile bay reach. A 6 to 8 minute time savings was noted from examination of ERDC vessel simulation data. The pilots contended that the time savings would likely be between 15 and 20 minutes. An average savings of 13 minutes (the midpoint between 6 and 20) was used to calculate project induced hydraulic time savings for vessels with beams over 80 feet. The equivalent annual 2006-56 benefits are displayed in Table 11.

Table 11

Corpus Christi Transit Time Savings Due to Deepening and Widening

Energy Savings Benefits a/

Year	Vessel Trips	Annual Savings
2000	740	$158,497
2006	786	$168,248
2016	868	$185,850
2026	958	$205,294
2036	1,059	$226,772
2046	1,170	$250,498
2056	1,292	$276,705
Equivalent Annual Benefits		$200,572

Channel Widening Benefit Summary

Savings associated with a reduction in delays due to beam and draft restrictions, resistance reductions, and ship-barge traffic interaction was identified for channel widening. Table 12 displays a summary of the project widening benefits.

CORPUS CHRISTI BARGE SHELF ANALYSIS

The CCSC's Upper Bay segment (mile 12 to mile 22) is characterized by intersection of deep-draft ship traffic coming from the Gulf of Mexico and inland waterway tug and barge traffic traveling on the GIWW. Congestion in the waterway has brought about traffic management rules governing maximum beam and draft to avoid collisions. The cost of this operating regime is manifested in vessel delays affecting deep-draft ocean-going vessels and shallow-draft tow barges. A barge shelf is proposed to separate the traffic and reduce the congestion induced delay cost.

Table 12

Summary of Channel Widening Benefits

	Widening Only	**Widening & Deepening**		
Year	Delays to Deep-Draft Vessels Due to Beam & Draft Restrictions, And Tug Availability	Transportation Cost to Deep-Draft Vessels From Resistance Reductions	Deep-Draft Vessel Delays From Ship-Barge Delays	**Widening Total**
2000	$240,326	$158,497	$164,090	$562,913
2006	$254,548	$168,248	$174,185	$596,981
2016	$389,571	$185,850	$192,409	$767,830
2026	$474,884	$205,294	$212,538	$892,716
2036	$524,568	$226,772	$234,775	$986,115
2046	$579,449	$250,498	$259,338	$1,089,285
2056	$640,073	$276,705	$286,469	$1,203,247
Equivalent Annual Benefits	$411,615	$200,572	$207,650	$819,837

The Upper Bay section of the CCSC is currently 45-foot x 400-foot. Traffic delays have four sources. The largest is the beam width restriction. Vessels are not allowed to pass if their combined beam width is greater than 251 feet. One vessel must delay in a safe area until the other vessel has passed. Tugs are required to assist vessels operating in the Inner Harbor. When tugs are not available, vessels must wait. The restricted draft results in large vessels delaying for adequate channel depth. The final source of delay, and the one that would be affected by a barge shelf, is the delay caused when towboats and ships are expected to meet at specific points in the Upper Bay segment of the ship channel. An example is the turn in the channel approximately one mile west of the junction between the CCSC and La Quinta Channel (Station 594+00). Pilots avoid meeting tow operators at this point by delaying. The Port Aransas Pilots estimate the incident of delays to be one out of every three ship movements. The average delay time was placed at 15 minutes. For the year 2000, 1254 incidents were estimated for a total of 313.5 hours delay time[1].

The reductions in transportation cost for deep-draft vessels associated with the barge shelf feature were calculated using the annual delay reduction of $250,000 (Economic Appendix). Under this scenario the incident of delay remains at one per three movements. Vessel traffic is forecasted to increase by one percent per year. The equivalent annual benefits for the 50-year period of economic evaluation were estimated at $309,453. The consensus of the deep-draft pilots was that two-thirds of the delay costs that they incur due to barge traffic would be alleviated by widening the deep-draft channel to 530 feet and one-third of the delays that the deep-draft vessels realize would be used by the barge shelf alone.

To determine savings for tow barges, representatives of three major tow-operating companies that regularly use the Corpus Christi Ship Channel were interviewed concerning the interaction between towboats and deep-draft vessels in the Upper Bay reach of the Corpus Channel. Of the three operators, two said that tow vessels delay, or "hold up", due to deep-draft vessel traffic between 30 and 33 percent of the time. The third company representative said that their operators indicated that they delay movements about 5 percent of the time. The estimated delay times were between 10 and 15 minutes. This information suggests that annual towboat delays are approximately $23,600. The annual delay cost was calculated using a 2-barge tow consisting of 195- by 35-foot barges and a 1,200 horsepower towboat and the annual tow trip forecast presented in Table 13. Examination of the barge fleet associated with study region transits showed that this tow size is representative of average tow dimensions. Table 14 presents a summary of the total benefits from the barge shelf.

[1] Letter dated October 9, 2001 from the Port Aransas Pilots association to the Galveston District.

Table 13

Annual Towboat Trip and Barge Shelf Equivalent Annual Savings

Upper Bay Reach

Year	1996	1997	1998	2006	2016	2026	2036	2046	2056	Equivalent Annual Savings
Towboat Trips	2570	2610	2814	3048	3366	3719	4108	4537	5012	
Annual Benefits			$23,597	$25,552	$28,225	$31,179	$34,440	$38,044	$42,024	$30,461

Source: USACE, dock-to-dock records. Growth for 1998-2056 was estimated at 1% per annum.

Table 14

Summary of Barge Shelf Benefits

Year	Deep-Draft Vessel Delays From Barge Induced Delays	Shallow-Draft Vessel Delays From Deep-Draft Induced Delays	**Barge Shelf Total**
2000	$82,291	$23,597	$105,888
2006	$87,354	$25,552	$112,906
2016	$96,493	$28,225	$124,718
2026	$106,588	$31,179	$137,767
2036	$117,740	$34,440	$152,180
2046	$130,058	$38,044	$168,102
2056	$143,665	$42,024	$185,689
Equivalent Annual Benefits	$104,137	$30,461	$134,598

LA QUINTA CHANNEL ANALYSIS

This section presents a summary of the La Quinta Channel analyses. The project alternatives investigated were deepening of the existing Federal portion of the La Quinta Channel and extension of the Federal project.

Deepening of the Existing Federal Project

Examination of the vessel sizes and trade routes associated with tonnage transported through the existing 45-foot channel showed that only a small number of vessels were loaded to drafts in excess of 40 feet. Additional analyses indicated that port depths of shipping and receiving ports were and would continue to remain a constraint. Comparison of the project construction costs to deepening the existing channel to depths over 45 feet with potential reductions in transportation costs associated with more deeply loaded vessels did not produce a benefit-to-cost ratio above unity.

Extension of the Federal Project

Determination of the Federal interest in extending the existing limits of the La Quinta Channel was evaluated based on the results of a multi-port analysis. The analysis was to determine if La Quinta Channel offered a competitive advantage over existing and anticipated container facilities such as the Port of Houston's Barbours Cut and Bayport projects, and the Texas City Shoal Point project.

Currently, a dedicated containerized cargo handling facility does not exist at any locale or landside terminal supported by the existing Corpus Christi Channel System. The PCCA performed studies to determine the economic viability of establishing a new terminal northward of the terminus of the existing La Quinta Channel and vessel turning basin (Container Terminal Alternative Site Analysis, Final Report). A critical consideration for the establishment of such facilities is whether incremental or marginal extension of the existing waterway can be justified to support the movement of vessel services to dockside facilities proposed for construction at the new terminal.

Initially, the PCCA considered three sites for establishment of containerized cargo facilities. These locales included the site presently identified for terminal development that is situated on the northern shore of an estuarine area, northwestward of the terminus of the channel. The other sites were located further southeastward, also along the northern or eastern shoreline and within reach of the existing channel system. The PCCA excluded these sites from further consideration due to costs of acquisition, development, and limitations imposed by proximity to landside rail linkages, vehicular access, capacity, and available land readily suitable for related development.

As stated previously, analyses for extension of La Quinta Channel emphasize the application of multi-port analyses. Preliminary inquiries and subsequent studies determined that presently, facilities do not exist (nor would they foreseeably exist without some level or scope of waterway improvements) and that little or a relatively insignificant portion of the cargo throughput that would be handled by new facilities would be comprised of induced cargo movements unique to

the new terminal. Consequently, studies assessed the tonnage movements currently handled or processed via some alternative port or terminal location in the absence of facilities proposed for La Quinta Channel.

The general approach of multi-port studies was to determine if facilities and supporting waterway improvements proposed for extension of La Quinta Channel would afford sufficient logistical or transportation cost efficiencies to allow attraction or cultivation of cargo throughput and business to economically justify the life-cycle costs of terminal development and waterway improvements over time.

La Quinta Channel Associated Costs

This section presents analysis of the costs associated with the development of the La Quinta container facility and provides a comparison of the project's associated costs with the expected transportation savings benefits and revenue. According to the PCCA's preliminary master plan, the terminal will be built in three phases. Phase 1 will be built in conjunction with the channel extension and will cost approximately $211 million. The first cost of $211 million is in addition to the channel deepening cost of $24 million. Phases 2 and 3 will proceed as need arises and will each cost approximately $68 million. Phase I cost includes wharf construction, container rails, site grading and paving, a 94-acre container terminal, 3 container cranes, 10 gantry cranes, 30-yard hostlers, reefer connections, and other yard equipment. The estimated average annual equivalent cost, which includes engineering supervision, administration and contingencies, is $21,773,932. The site development costs were annualized over the 50-year period of economic evaluation for evaluation in relationship the equivalent annual benefit stream anticipated from the proposed facility.

Along with site development costs, the associated costs needed to realize the project benefits include daily facility operation expenses. Anticipated operation and maintenance costs for the facility were estimated using budget data for comparable ship terminals presently servicing dry cargo goods at other U. S. Gulf Coast ports. Additionally, the port's 1999 and 2000 annual reports were reviewed and pertinent data were pro-rated based on the expected throughput volume for the La Quinta facility. Operating expenses include direct and indirect costs for employee services, utilities, telephone, insurance, security, office equipment and administrative services. The combined estimated average annual equivalent associated costs for both site development and operation and maintenance totals $23,534,546.

La Quinta Channel Container Revenue

The revenue stream expected from the proposed container cargo facility was evaluated in relationship to total project cost. Expected revenue was used as a proxy for evaluating the port's ability to generate returns sufficient to cover the La Quinta channel extension costs and the associated site facility and operational costs. The port expects to find a private terminal operator to undertake these investments and operate the public, common carrier facility at a profit. There is expected to be little public investment in the entire La Quinta Terminal. Normal shipping costs, which include terminal charges, berth charges, crane costs, yard storage costs, rail and truck costs can all be expected, whether containers move through La Quinta or any other facility. Annual revenue expected from the container terminal is estimated at nearly $77.5 million. More detailed analysis of associated costs is included in the Economic Appendix.

La Quinta Project Construction and Associated Cost and Benefit Evaluation

As displayed in Table 15, the first cost for construction of the La Quinta 39-foot channel extension is $23,968,000 and average annual equivalent project costs, which include channel operation and maintenance, is $2,044,471. The expected annual transportation cost savings benefits for the 39-foot channel depth are $9,264,460. The benefit-to-cost ratio based on the equivalent annual benefits of $9,264,460 and annualized project cost of $2,044,471 is 4.5. Inclusion of the average annual associated costs increases the equivalent annual cost from $2,044,471 to $25,579,017. Revenue generated from container traffic will be used to payback the sponsor's site investment costs. Comparison of the combined channel construction and landside facility cost of $25,579,017 with the combined annualized transportation cost savings of $9,264,460 and associated revenue of $77,495,120 produces a return of 3.4. Calculation of the rate of return for the NED throughput and the full facility cost is of 1.0. Comparison of the full facility construction cost and the NED throughput represents a relatively "worst case" test condition as it is based on the low cargo throughput and maximum project cost. The cost needed to realize the NED benefits would be less than the full facility cost. The cost difference would be reflected in the cargo handling equipment cost. The cargo handling equipment cost represents 36 percent of facility cost. It should be noted that the port would be less inclined to construct the facility if they did not anticipate capturing the higher volumes identified in the market analyses; however, the associated cost analysis demonstrates that the transportation cost benefits and associated tariff generated revenues are sufficient to cover the water and landside construction and maintenance cost based on the Port's expected tonnage throughput.

CORPUS CHRISTI AND LA QUINTA CHANNELS BENEFIT SUMMARY

Table 15 displays a summary of the NED benefits for deepening the Corpus Christi Channel, widening the bay reach, and extending the La Quinta Channel. The project benefits were calculated at 5.875 percent interest and are for the period 2006-56.

Table 15

Construction Cost and Benefit Summary

	First Cost	Average Annual Cost	O&M Cost	Total Cost a/	Annual Benefits	B/C Ratio	Net Excess Benefits
			Corpus Christi Channel Deepening and Widening				
48x530	$109,687,247	$6,837,904	$947,809	$7,785,713	$15,571,529	2.0	$7,785,816
50x530	$143,475,000	$8,944,233	$1,303,607	$10,247,840	$24,405,167	2.4	$14,157,327
52x530	$156,984,000	$9,786,384	$1,669,900	$11,456,284	$32,606,650	2.8	$21,150,365
			Corpus Christi Barge Shelf				
	$1,257,000	$78,361	$26,982	$105,343	$134,598	1.3	$29,255
			La Quinta Channel				
48	$12,683,000	$790,658	n/a	$790,658	$482,169	0.6	($308,489)
50	$13,279,000	$827,813	n/a	$827,813	$702,502	0.8	($125,311)
52	$13,297,700	$828,979	n/a	$828,979	$702,502	0.8	($126,477)
			La Quinta Channel Extension				
36	23,195,000	$1,445,692	$546,850	$1,992,542			
37	23,557,500	$1,468,575	$547,824	$2,016,398	$8,913,620	4.4	$6,897,222
38	23,920,000	$1,491,173	$548,797	$2,039,970	$9,230,160	4.5	$7,190,190
39	23,968,000	$1,494,165	$550,306	$2,044,471	$9,264,460	4.5	$7,219,989
40	24,016,000	$1,497,158	$551,815	$2,048,973	$9,238,000	4.5	$7,189,027
41	24,418,000	$1,522,218	$556,424	$2,078,642	$9,145,880	4.4	$7,067,238
42	24,820,000	$1,547,279	$561,032	$2,108,311	$9,145,880	4.3	$7,037,569

a/ The 48-foot project cost was estimated by applying the December 1999 to 2001 price change factor to the December 1999 costs. The costs for deepening of the existing La Quinta Channel reflect 1999 prices. The costs for La Quinta 37-, 39-, and 41-foot depths were interpolated.

Based on the economic analysis, the NED plan includes deepening the CCSC from 45 to 52 feet, widening of the CCSC to 530-feet wide, barge shelves 200 feet wide on each side of the Upper Bay reach of the CCSC, and extension of the La Quinta Channel at a 39-foot depth. The CCSC widening only and La Quinta Channel deepening alternatives did not generate sufficient benefits for further consideration as part of the NED plan.

VII. 50-YEAR DREDGED MATERIAL MANAGEMENT PLAN EVALUATION AND SELECTION

PLACEMENT PLANS CONSIDERED

Deepening and widening of the CCSC, as well as the extension of the La Quinta Channel, will generate approximately 41 million cubic yards (mcy) of new work material and 208 mcy of maintenance material over the 50-year life of the project. Approximately 3000 acres of upland confined placement areas as well several partially contained and open water, dispersive sites with unlimited capacity exist for development of a viable placement plan.

To evaluate alternatives for placement of this material, three feasible placement plans were developed. They are titled as follows: The Gulf Placement Plan, The Upland Confined Placement Plan, and the Beneficial Use Placement Plan. Each plan mixes possible placement methods to maximize beneficial uses while minimizing costs.

Each of these plans has similar concepts and differs only in the La Quinta and Upper and Lower Bay reaches. No alternative other than upland, confined placement was considered for the Inner Harbor, due to the availability of existing sites adjacent to this channel reach with sufficient capacity for the required maintenance as well as concerns about contaminants in this highly industrialized area. Due to the nature of material in the Upper Bay reach, creation of habitat as a beneficial use was not an option, and impacts associated with open bay placement have been evaluated and shown to have minimal impacts.

Gulf Placement Plan

An EPA approved ocean dredged material disposal area (PA 1) exists approximately one mile southeast of the jetties (Figure 1). The area is a dispersive site in the Gulf and has unlimited capacity. In addition, potential exists for beneficial use sites where material can be placed to create topographic relief for fishery enhancement.

In this alternative, all of the new work material from the Upper and Lower Bay portion of the channel was evaluated for placement offshore.

Upland Confined Placement Plan

There are several existing upland confined sites available for use throughout the bay system. The Inner Harbor has several sites including Suntide (IH-PA 8), Tule Lake (IH-PA 6), South

Shore (IH-PA 3), Rincon, (IH-PA 2), and IH-PA 1. These PAs are divided into cells that range in size from 183 acres to 360 acres. Mustang Island (PA 6), a 304-acre PA adjacent to the CCSC in Lower Bay is also available, as is PA 13, which is adjacent to the La Quinta Channel and is 750 acres in size. PA 10, a 196-acre site on the south side of the ship channel across from Port Ingleside is also available for use. PA 4 is another confined site located on Harbor Island along and north of the CCSC just west of the Inner Basin.

In this alternative all of the material from the La Quinta extension and from Station 540+00 to the Inner Basin would be placed in upland confined sites. PA 13 has sufficient capacity to hold all of the new work material from the La Quinta extension but capacity would be exceeded when taking into consideration maintenance material. For the Lower Bay portion of the channel, PA 6 was considered for the placement of all new work material. Because new work dredging in this area would generate 8.754 mcy of material, it would be infeasible for all of this material to be placed in PA 6. This would require that the PA size be increased. Redfish Bay has more sensitive, shallow water habitat than other portions of the bay system, and expanding PAs would permanently remove this habitat from the system. Because of the environmental sensitivity of this alternative it was removed from consideration.

Beneficial Use Placement Plan

One of the main interests in the consideration of a 50-year dredged material management plan was to maximize the use of suitable quality dredged material for beneficial purposes. In coordination with the resource agencies and the public, several beneficial uses were investigated to determine the feasibility of implementation. Placement possibilities and their feasibility are discussed below.

Entrance Channel

PA 2, a partially unconfined site on San Jose Island, has been used in the past for the placement of sandy material to nourish the dune field and beach just north of the entrance jetty. No material is scheduled for placement at this site, however, it will be included as a part of the authorized project should opportunity to use material beneficially arise.

Material generated from deepening the entrance channel is made up of both sandy and clay material. Because of the nature of the material, beneficial use options were considered, including creation of feeder berms offshore and placement of material on the shoreline for beach nourishment. However, the material has an insufficient proportion of sand, and if placed on the beaches, would have negative aesthetic impacts. Because of this, only offshore beneficial use options were given further consideration.

Lower Bay Portion of the Channel

Another option available at this location, in addition to the existing contained sites, is Pelican Island (PAs 7 and 8). These sites have been used in the past for the placement of sandy maintenance material in an effort to maintain the island as an important bird nesting habitat.

The material composition in this reach is sandy, for both new work and maintenance, which lends itself to beneficial uses. Alternatives considered included placement in upland sites, placement of all material offshore, and placement in beneficial use sites. Because the amount of material to be dredged will exceed placement capacities of the confined sites in the area, use of these sites was not considered feasible. Costs were developed for alternatives, including offshore placement, but this alternative was more costly than beneficial alternatives.

Upper Bay Portion of the Channel

Previous practice in this reach has involved placement of material in eight open bay PAs (14A through 17B). These sites are currently being used for maintenance material dredged from the CCSC across the bay, and have essentially unlimited capacity.

Due to the silty nature of the existing material to be dredged from this reach, no beneficial use options were considered for a majority of the material. Some of the material on the eastern end is of sufficient quality to be used beneficially.

Inner Harbor

Sufficient capacity exists for both new work and maintenance material in existing upland sites immediately adjacent to the Inner Harbor. Because of this, no additional alternatives were considered that would require pumping long distances to other confined sites. Also, development of additional sites in other areas would require purchase of real estate. All existing sites adjacent to the Inner Harbor are currently owned and maintained by the PCCA. Because of these factors, it was determined that the use of existing upland, contained sites in the Inner Harbor is the least cost alternative.

The potential for contaminants in the material removed from the Inner Harbor precluded consideration of beneficial use options. The Contaminants Workgroup considered the presence of contaminants and evaluated existing data, and no concerns were identified. However, the workgroup recommended that, rather than potentially suspend buried contaminants into the aquatic environment, all new work and maintenance material should be placed in existing upland

confined sites adjacent to the channel in this area. Due to the identification of this portion of the placement plan as least cost, and the recommendation of the Contaminants Workgroup, no additional consideration was given to other alternatives.

La Quinta Extension

Extension of the La Quinta Channel will generate approximately 6.2 million cubic yards of material. A majority of the material to be removed during construction of the extension will consist of either stiff to hard clay or dense to medium dense sand. Because of the quality of the material several beneficial alternatives were considered, including habitat creation, use of material on adjacent uplands to create sound and aesthetic buffers between residential and expected industrial property, as well as use in increasing capacity of existing placement areas. Because the material was considered suitable and sufficient quantity exists, all three options were further evaluated as part of a BU Placement Plan.

After development of costs for both the Gulf Placement Plan and the Beneficial Use Placement Plan (Table 16), it became clear that the BU Placement Plan was the least cost alternative. Also, when considering potential impacts associated with the proposed Upland Placement Alternative, the BU Plan exhibits the greater potential for environmental enhancement. For this reason, the BU Plan has been identified as the NED plan.

Table 16
Cost Comparison for Placement Alternatives
(in $000)

	CCSC Beneficial Use Alternative	CCSC Upland Placement Alternative	CCSC Gulf Placement Alternative	La Quinta Beneficial Use Alternative	La Quinta Upland Placement Alternative
First Cost	$156,984	$170,151	$219,739	$24,016	$22,966
Maintenance Cost (50 yr)	$372,851	$435,006	$831,169	$30,048	$42,437
Total Cost	$529,835	$605,157	$1,050,908	$54,064	$65,403

DREDGED MATERIAL PLACEMENT PLAN

Deepening and widening of the CCSC, as well as the extension of the La Quinta Channel, will generate approximately 41 mcy of new work material and 208 mcy of maintenance over the 50-

year life of the project. Dredged material of sufficient quality will be used in a beneficial manner. Suitable material removed from the CCSC and the La Quinta Channel that will be used beneficially constitutes the least-cost plan (NED Plan). The RACT, Beneficial Use, and Contaminant Workgroups have reviewed the placement plan for water quality concerns and raised no issues. The plan has been broken down by channel segment and is described below.

Entrance Channel

All material, both new work and maintenance will be placed in offshore sites. All of these sites are unconfined and no structural control will be utilized to contain material. New work material will be placed into two beneficial use sites based on composition of the material. Material from Station 301+00 to 150+00 has a higher percentage of silt and clay and will be placed in BU Site ZZ. Material from Station 150+00 to -37+82 has a larger percentage of sand and will be placed on BU Site MN. Maintenance material from the Entrance Channel will continue to be placed in PA 1, a site previously designated for the 45-foot project. Sufficient capacity exists for the proposed project. PA 2 is a partially confined placement area located on San Jose Island and is also currently used for maintenance material when pipeline dredges are utilized to dredge the western portion of this reach and the eastern portions of the Lower Bay reach. This practice will continue for maintenance when and if suitable material is available.

Lower Bay portion of the CCSC

A majority of the new work material, as well as maintenance material, is high quality sand and will be used in several beneficial use sites. The easternmost portion of this reach, from Station 12+55 to 180+00, has a large soft silt and soft clay component and will be placed in PA 6. The remainder of new work material, from Station 180+00 to 549+00, will be utilized to create BU Sites I, R, and S, and a portion will be used to enhance Pelican Island (PAs 7 and 8). The maintenance material for the entire Lower Bay reach is made up of sand and silty sand, suitable for placement in a BU site. Because of this, all of the expected 11.7 mcy of maintenance material will be placed on Pelican Island, as is present practice.

BU Components - BU Sites I, R, and S will range in size from 121 to 201 acres. All three sites will utilize rock breakwaters to protect and contain dredged material as well as create hard substrate habitat. Material will be placed in the sites to raise the bottom elevation to approximately 1-2 feet below mean low tide (MLT), suitable for seagrass colonization. No seagrass planting will be performed. Instead, the areas will allow seagrass to vegetate through natural colonization. Rock breakwater will be used to protect two of the three sides of Site I (Figure 2). Site I will be placed north of the CCSC and southeast of the existing Dagger Island. Dredged material will be allowed to mound in several locations within this site to create a

diversity of habitat types, ranging from submerged to fully emergent areas. Planting of *Spartina alterniflora* will be performed in these emergent areas to enhance the habitat created. BU Sites R and S will be located on the southern shore of PAs 10 and 9, respectively (Figure 3). Both sites will be semi-circular and protected from erosion by rock breakwaters. The breakwaters on all three sites will incorporate openings to insure tidal flow in and out of the area.

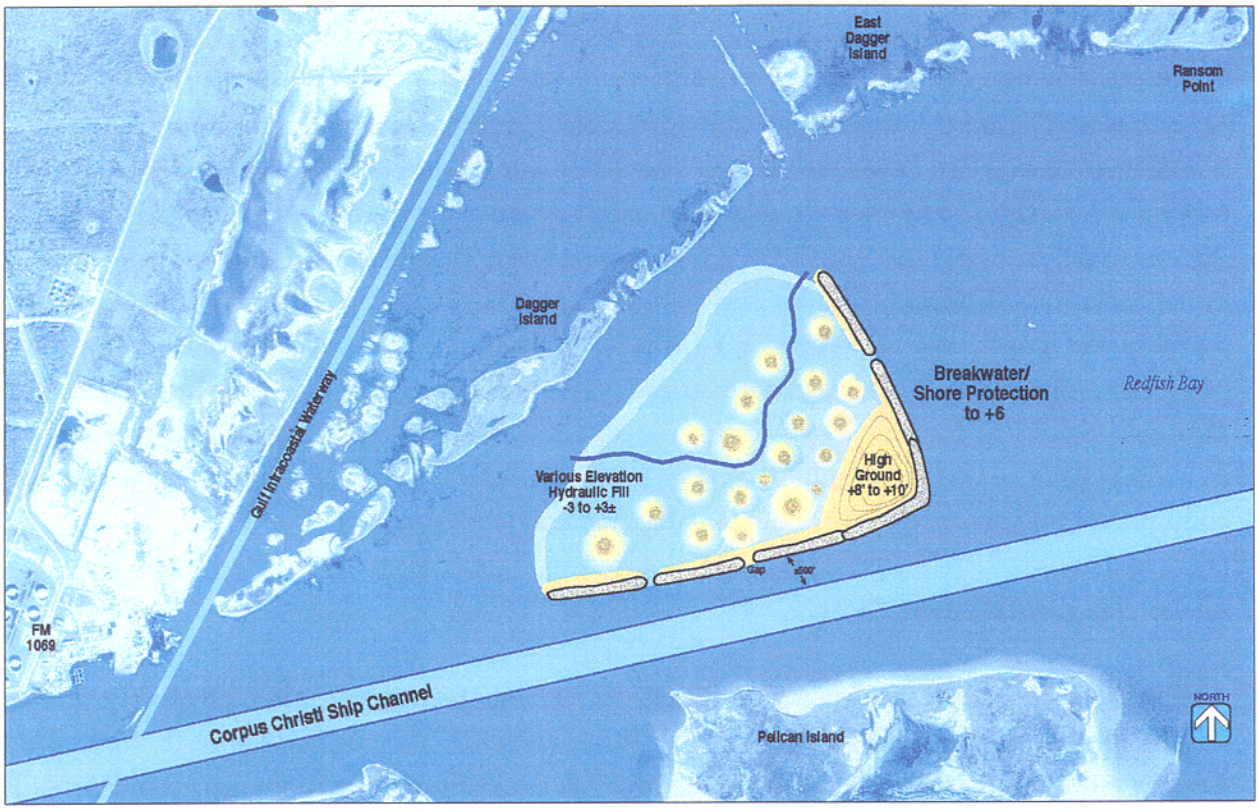


Figure 2
Beneficial Use Site I
Lower Bay

Three other environmental features have been developed as a part of this plan. These incorporate the use of rock breakwaters and geo-tubes for the control of erosion to protect existing habitat. Site L, measuring approximately 7,500 feet, would consist of construction of a rock revetment at the shoreline between the CCSC and an existing, high quality, marsh area west of Port Aransas. This shoreline revetment would protect a complex system of sand flats and wetlands measuring approximately 1200 acres in size. Two gaps would be left in the revetment to maintain water movement through two sloughs that currently connect the wetland complex and CCSC. Site P, measuring approximately 2,400 feet in length, consists of a rock breakwater constructed adjacent to Ingleside on the Bay (Figure 4). This structure will protect and enhance approximately 40 acres of existing seagrass beds that are currently exposed to high-energy wave action caused by

winds and ship/boat wake. Neither BU Site L nor P would utilize dredged material but was developed in conjunction with the Dredged Material Placement/Beneficial Use Plan. Rock breakwater, in conjunction with geo-tubes filled with dredged material, will also be used to protect high quality rookery and nesting habitat on Pelican Island. The breakwater would protect the northeastern corner of the island. The geo-tube would extend south from this breakwater and be utilized to help contain future maintenance material scheduled for placement on the island.

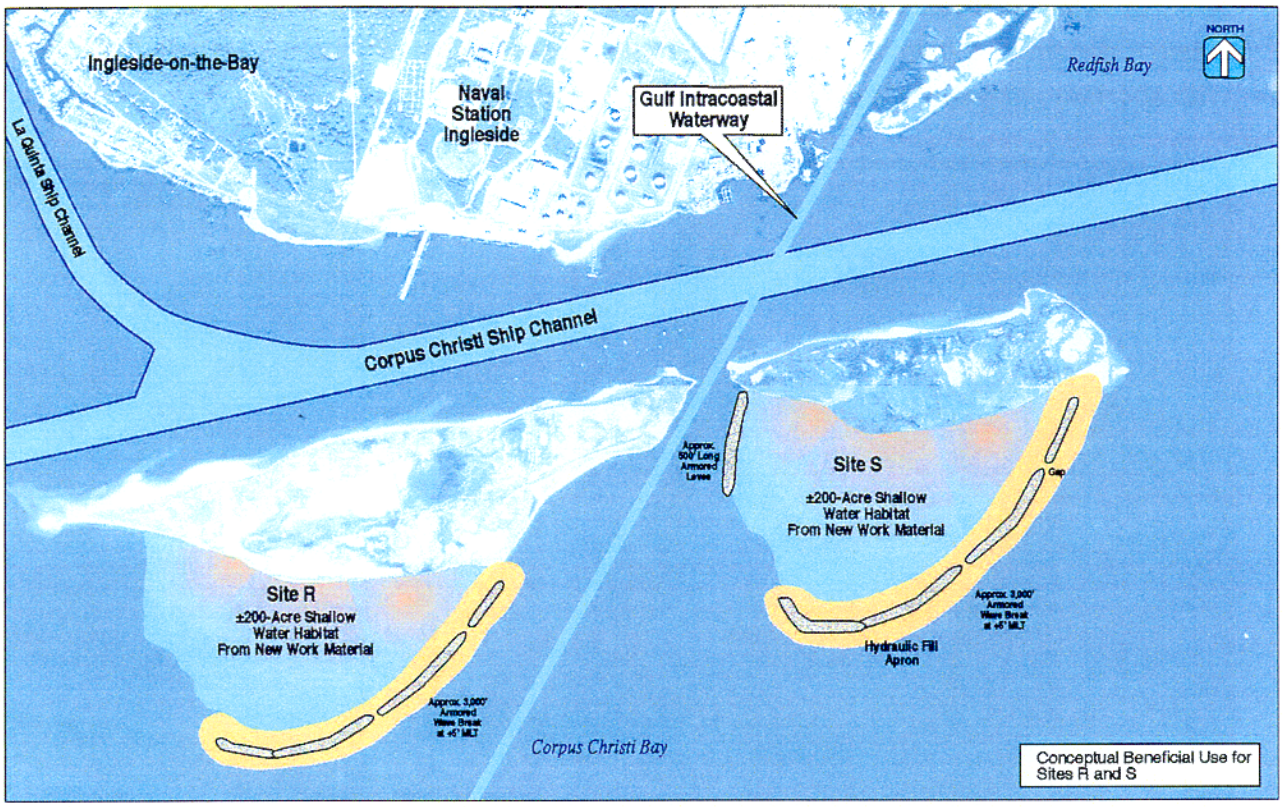


Figure 3
Beneficial Use Sites R and S
Corpus Christi Bay

Upper Bay portion of the CCSC

Widening and deepening of the channel, as well as construction of the barge shelves, in this portion of the CCSC will generate approximately 14.5 mcy of new work material and 82 mcy of maintenance material over the 50-year life of the project. New work material is largely made up of soft silt and soft sandy clay while the maintenance material is expected to be comprised of silt or sandy silt. Because of its consistency, all of the material, from Station 649+00 to 1080+00, will be placed in PAs 14-A through 17-B. Material from the eastern reach (Station 549+00 to 649+00) has a larger sand and clay component and will be used to construct BU site CQ.

BU Components - Site CQ, measuring approximately 250 acres in size, will be constructed northwest of the La Quinta Junction (Figure 4). Three sides of the site will utilize rock breakwater protection. The north edge will remain open. Material will be placed in the site to raise the bottom elevation to approximately 1-2 feet below MLT, suitable for seagrass colonization. No seagrass planting will be performed. The areas will allow seagrass to vegetate through natural colonization. A series of mounds will be created in this site similar to those in Site I in order to reduce the impact of fetch on the material during initial construction and to create a diversity of habitat after construction. The shoreline of these mounds will be planted with *Spartina alterniflora* to enhance the habitat created.

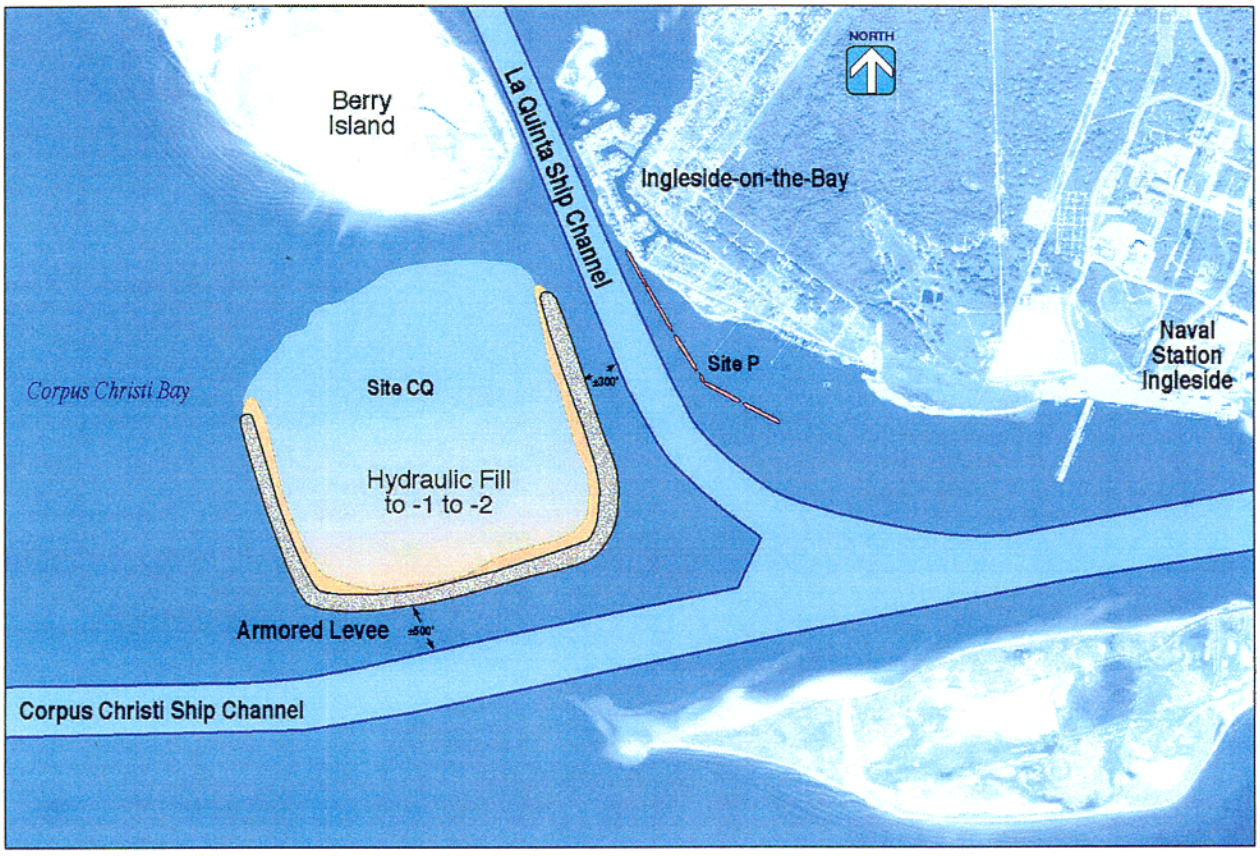


Figure 4
Beneficial Use Site CQ
Upper Bay

Inner Harbor

The placement areas available for use in this reach include IH-PA 1, IH-PA 2, IH-PA 3A, IH-PA 3B, IH-PA 3C, IH-PA 6, and IH-PA 8. All of these facilities are located in the immediate

vicinity of the channel and have sufficient capacity for maintenance material over the period of economic evaluation (50 years).

Because of the industry located in this reach, the Contaminants Workgroup and RACT raised concerns about the potential for resuspension of contaminants during any attempt at beneficial use. Detailed contaminant testing was not requested. Based on agency recommendations, all of the new work and maintenance material from Station 1080+00 to 1561+00 (Viola Turning Basin) will be placed in upland confined sites and not utilized beneficially.

La Quinta Channel

New work material generated from the extension of the La Quinta Channel will be placed in three locations. Approximately 2.7 mcy will be placed in PA 13, and, due to its large clay component, be used in the future to elevate the levees of the PA to contain future maintenance material. Another 2.5 mcy of sandy material will be placed in BU Site GH to create shallow water habitat. BU Site E will receive approximately 1 mcy of material. Maintenance material from the entire La Quinta channel will be placed in PAs 10 and 13.

BU Component - BU site GH will extend westward from the end of PA 13, and will be protected on its southern edge by a rock breakwater (Figure 5). Dredged material will be utilized to raise the bottom elevation to approximately 1 to 2 feet below MLT. Adjacent to the breakwater, material will be placed so as to create emergent habitat. These areas will be planted with *Spartina alterniflora* to enhance the habitat created. Because dredging the La Quinta Channel extension will impact five acres of seagrass a portion of BU Site GH will be used to perform mitigation. Fifteen acres of newly created shallow water area in BU Site GH will be transplanted with seagrass and monitored to insure success. The Mitigation Workgroup developed the 3:1 mitigation ratio. After incremental analysis the BU and Mitigation Workgroups proposed mitigation in this form after evaluation of several factors. All existing aquatic areas that have depths suitable for seagrass transplantation are already vegetated. Scraping down existing uplands to create areas of proper depth could create additional aquatic habitat, but at a high cost to the project. However, when considering that several hundred acres of habitat suitable for SAV growth will be created through the BU plan, it is clear that it is more cost effective to utilize the areas created when considering mitigation. The BU plan calls for the creation of several sites that would modify deeper areas by bringing them to a depth suitable for seagrass colonization. Based on these considerations, it is most advantageous to mitigate impacts to seagrasses through planting of 15 acres within the newly created BU Site GH. This site is close to the area of impact and will assist seagrass colonization in the remainder of the site.

BU Site E will measure approximately 100 acres in size and be placed on the western edge of the Port's proposed container terminal. The placement area will be enhanced during the development of the PCCA's proposed container terminal facility to create a buffer zone between the proposed facility and the adjacent residential and recreational properties.

Several PA's not detailed in this report are designated for placement of new work and maintenance material from the existing, authorized 45-foot deepening project. While not scheduled for use at this time, these areas are available for the 52-foot project, if needed. These PA's include:

IH-PA's 4 and 5, which are privately owned, but are potentially available for use through an agreement with the landowner or by navigation servitude. IH-PA 4 and IH-PA 5 were last used 23 years ago during the CCSC 45-foot deepening project.

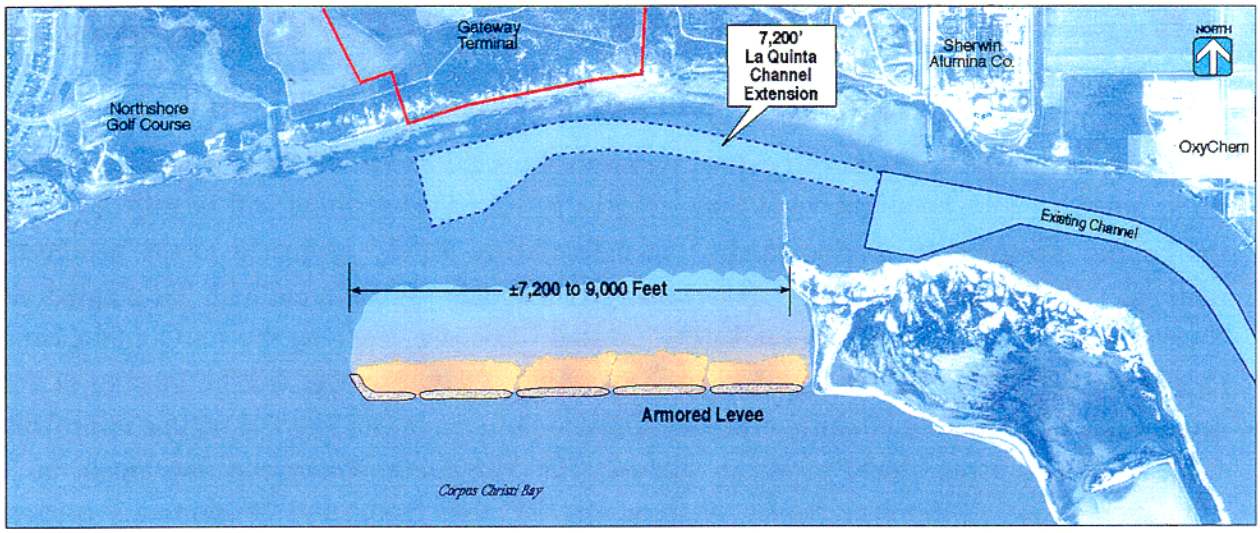


Figure 5
Beneficial Use Site GH
La Quinta Extension

PA 4 is a confined site located north of the CCSC on Harbor Island. It has not been used since the 45-foot deepening project for the placement of new work dredged material. It is owned by the PCCA and may be available for use by the proposed project.

PA 5 is an upland unconfined site located on the south side of the CCSC west of Port Aransas. It has not been used since before the CCSC was deepened to 45 feet and may be available for use by the proposed project through navigation servitude.

PA 9 is an unconfined emergent placement area located south of the CCSC and east of the GIWW crossing. It has not been used in the past 23 years. It was last used for placement of new work material during the 45-foot deepening project.

PA 18 is an unconfined open-water placement area that is configured as two narrow parallel placement corridors oriented perpendicular to the CCSC. PA 18 is available for use, but has not been used recently because of concerns that it could accelerate filling of the small boat channels near the Corpus Christi City Marina.

SUMMARY

Contaminant studies demonstrated that new work and maintenance dredged material from all sections of the channel, with the exception of the Inner Harbor, is acceptable for offshore disposal, beneficial uses in the bay or ocean, or upland disposal. Because of the availability of existing placement areas in the vicinity of the Inner Harbor and the potential for contaminant resuspension, this material will be placed in existing, nearby upland sites to remove it from the system. This was identified as the least cost alternative for the Inner Harbor reach.

The Beneficial Uses Workgroup of the Regulatory Agency Coordination Team developed a dredged material management/beneficial use plan that utilizes dredged material in an environmentally sound and economically acceptable manner and that incorporates other public benefits into its design. Beneficial uses of dredged material investigations identified a plan that will result in the following: creation of 935 acres of shallow water habitat, creation of 15 acres of submerged aquatic vegetation (as mitigation), creation of 26 acres of marsh, construction of 26,400 linear feet of rock breakwater, creation of 1,590 acres of offshore topographic relief, construction of 120 acres of upland buffer zone, construction of 7,500 linear feet of rock revetment, protection of 45 acres of submerged aquatic vegetation, protection of an existing bird island, and protection of 400+ acres of wetlands. Channel enlargement will result in direct permanent and temporary losses to 5 acres of patchy submerged aquatic vegetation, which will be mitigated through creation of 15 acres of submerged aquatic vegetation. The cumulative impact assessment showed that the proposed navigation improvements with the beneficial use plan will result in a net positive environmental effect to the Corpus Christi Bay ecosystem than for the without project condition.

VIII. DESCRIPTION OF SELECTED PLAN

Based on the economic, engineering, and environmental factors considered, the selected plan includes deepening of the CCSC from Viola Basin to the end of the jetties in the Gulf of Mexico to -52 feet MLT, deepening of the remainder of the channel into the Gulf of Mexico to -54 feet MLT, widening of the Upper Bay and Lower Bay reaches to 530 feet, construction of 200-foot wide barge shelves to –12 feet MLT across the Upper Bay portion of the CCSC, and extending the La Quinta Channel 7,400 feet at a depth of -39 feet MLT. It is estimated that the approximately 41 million cubic yards of new work material would require seven separate dredging contracts to complete. The work is estimated to begin in April 2004 and be complete by January 2009. Dredged material management will be performed according to the Dredged Material Placement Plan described in Section VII.

GENERAL NAVIGATION FEATURES OF THE CCSC SELECTED PLAN

Entrance Channel

The Entrance Channel is defined as that portion of the CCSC extending from Station 310+00 in the Gulf of Mexico to Station -37+82 in the Inner Basin. It is 700 feet wide and protected on two sides by jetties. The land locked portion of the Entrance Channel would be deepened to 52 feet plus 2 feet of advanced maintenance. This would be modified in the portion of the channel that enters the open waters of the Gulf. This segment will be dredged to a 54-foot authorized depth with two feet of advanced maintenance to insure safe vessel passage in a high wave energy environment. The existing channel will be extended an additional 10,000 feet into the Gulf in order to reach the 56-foot contour. Minor widening of 100 feet is necessary on the northern side of the channel for approximately 4,000 feet adjacent to San Jose Island based on the results of ERDC's Ship Simulation Report. This will improve the turning radius for vessels passing through the entrance channel and making the turn either out to the Gulf or into the Lower Bay portion of the channel.

Lower Bay portion of the CCSC

The Lower Bay portion of the CCSC extends from Stations 12+55 in the Inner Basin to Station 540+00 just west of the La Quinta Junction. This segment will be deepened from 45 feet to 52 feet plus 2 feet of advanced maintenance. Based on the ERDC's Ship Simulation Report, the selected width for this portion of the channel is 530 feet. The eastern portion of this channel segment is currently wider than the selected 530 feet and will remain as is; therefore, no

widening will be necessary in this reach. The western portion of this reach measures approximately 500 feet in width and will be widened to 530-feet.

Upper Bay portion of the CCSC

The Upper Bay segment is defined as that portion of the CCSC extending from Station 540+00 near the La Quinta junction to Station 1050+00 near the Harbor Bridge. This reach is currently 400 feet wide and 45 feet in depth. This portion of the channel which crosses the open water segment of Corpus Christi Bay is the most physically restrictive in terms of width in addressing the need for ships to pass safely and in a timely manner. This entire stretch will be widened to 530 feet, based on the results of ERDC's Ship Simulation Report. This reach will also be deepened to 52 feet with 2 feet advanced maintenance.

Inner Harbor

Since the Harbor Bridge and Tule Lake Lift Bridge currently prevent two-way traffic in the Inner Harbor portion of the channel, no consideration was given to alternatives that would widen this reach. The Inner Harbor segment, measured from Station 1050+00 to 1561+00, will be deepened to 52 feet plus advanced maintenance. The channel width will range between 300 and 400 feet. Several minor modifications will be made to the turning basins to insure that they meet USACE navigation requirements. One basin, the Avery Point Basin, will not meet USACE width criteria due to the presence of industry on the shoreline of the channel. In the vicinity of the Tule Lake Lift Bridge, because the bridge may be removed and/or replaced, plan formulation was performed assuming that the channel width in this area will be 400 feet. This width is consistent with the remainder of the Inner Harbor channel segment. Making the channel width consistent in this area, should the bridge be removed, will allow the construction of a channel consistent with Corps criteria, as well as creating a safer passage through the channel for all ship traffic. Should the bridge remain at the time of project construction, channel width will be limited to 200 feet to insure no impacts to the bridge supports. This 200-foot width is sufficient to allow all expected traffic access beyond the bridge. The continued presence of the bridge will not prevent the realization of benefits described in the economic analysis portion of this document.

GENERAL NAVIGATION FEATURES OF THE BARGE SHELF SELECTED PLAN

To evaluate the need for barge shelves across the bay, ERDC established video monitoring of barge traffic in the area. Because sufficient depths exist across a large portion of the bay adjacent to the channel, barge shelf markers were placed outside of the existing deep-draft

channel to aid pilots. The video monitoring of these lanes suggests that widths currently marked with navigation aids are sufficient for the entire barge shelf. The existing aids to navigation are located approximately 200 feet from the bottom edge of the existing deep-draft channel. Based on information from ERDC's video monitoring, discussion with pilots in the area, need for minimal dredging, economic benefits, and enhanced safety, the barge shelves are to be dredged to 200 feet in width. The shelves will be constructed on both sides of the channel, will be located from Station 540+00 to Station 1070+00, and will be dredged to a depth of 12 feet with 2 feet of advanced maintenance.

GENERAL NAVIGATION FEATURES OF THE LA QUINTA CHANNEL EXTENSION SELECTED PLAN

The La Quinta Channel will be extended approximately 7,400 feet beyond its current limit at Station 309+30. The channel will measure 400 feet wide and a second turning basin with a 1,200-foot radius will be constructed. The existing limits of the La Quinta Channel will remain at the 45-foot depth; however, the extension will be dredged to 39 feet with 2 feet of advanced maintenance.

The Port of Corpus Christi Authority performed an alternatives analysis on potential sites for their proposed container terminal. After a broader screening analysis three sites were evaluated, including the currently proposed La Quinta location. The other two sites were identified as the Welder site and National Steel site.

Based on factors including development costs, property configuration and operational efficiency, access to roadway and rail infrastructure, land use, and access to a navigable channel, the port determined that the La Quinta site was the best suited for placement of a proposed container facility (Port of Corpus Christi Authority Container Terminal Alternative Site Analysis, Final Report, Goldston Engineering, 4/17/2001).

Because of the relationship between the extension of the existing Federal project and the proposed terminal, the PCCA must initiate construction of the terminal facilities prior to, or concurrent with, construction of the La Quinta Channel extension. The PCCA will be responsible for obtaining the necessary permits required for the container terminal under Section 404 of the Clean Water Act, Section 10 of the Rivers and Harbor Act, and/or any other applicable jurisdictions as appropriate utilizing the procedures described by NEPA.

SEPARABLE ECOSYSTEM RESTORATION FEATURES OF THE SELECTED PLAN

Three environmental features have been developed as a part of this plan. Early in plan formulation, three specific areas exhibiting extremely sensitive habitat were identified and opportunities considered protecting and preserving them. These habitats include an area exhibiting healthy stands of submerged aquatic vegetation, an expansive inter-tidal marsh and sand flat habitat, as well as an island utilized heavily as a nesting site by shore birds. All three habitats are located adjacent to the Corpus Christi and La Quinta Ship Channels and all are in danger of degrading over time if not protected in the near future.

These plans all incorporate the use of rock breakwaters and geo-tubes for the control of erosion to protect these existing habitats. Site L, measuring approximately 7,500 feet, would consist of construction of a rock revetment at the shoreline between the CCSC and an existing, high quality, marsh area west of Port Aransas. This shoreline revetment would protect a complex system of sand flats and wetlands measuring approximately 1200 acres in size. Two gaps would be left in the revetment to maintain water movement through two sloughs that currently connect the wetland complex and CCSC. Site P, measuring approximately 2,400 feet in length, consists of a rock breakwater constructed adjacent to Ingleside on the Bay (Figure 4). This structure will protect and enhance approximately 40 acres of existing seagrass beds that are currently exposed to high-energy wave action caused by winds and ship/boat wake. Neither BU Site L nor P would utilize dredged material but was developed in conjunction with the Dredged Material Placement/Beneficial Use Plan. Rock breakwater, in conjunction with geo-tubes filled with dredged material, will also be used to protect high quality rookery and nesting habitat on Pelican Island. This island is adjacent to and south of the Lower Bay Reach of the CCSC. The breakwater would protect the northeastern corner of the island. The geo-tube would extend south from this breakwater and be utilized to help contain future maintenance material scheduled for placement on the island. The breakwater and maintenance material would be utilized to insure that the island remains, and no work would occur on the island during nesting season.

TIDAL AND SALINITY CHANGES ASSOCIATED WITH THE SELECTED PLAN

Computer modeling of the selected plan was undertaken to evaluate potential changes to tide and salinity in the project area. A two-dimensional finite element hydrodynamic and salinity model was used to simulate the existing condition as well as the selected plan. Two years, 1993 and 1994, were chosen for the tidal simulation and two two-year periods were chosen for salinity simulation, 1988 and 1989 as a normal to dry period and 1991 and 1992 as a normal to wet period.

Construction of the selected plan will not change the average tide significantly in the Corpus Christi Bay and surrounding area. On average, it will fluctuate by 0.01 feet or less. The average tidal range will increase by 0.04 to 0.06 feet in Corpus Christi Bay and Nueces Bay, 0.02 feet in the JFK Causeway area, 0.01 feet in the upper Laguna Madre and Baffin Bay, while it will decrease by 0.02 feet in Aransas Bay and Copano Bay.

Analysis of current changes due to construction of the beneficial use sites was also performed, due to the potential to increase erosion. Only slight increases in current were simulated adjacent to new BU sites, and no increase in erosion is expected.

There has been a long-term increase in salinity in Corpus Christi Bay of about 0.1 part per thousand per year. This is likely from long-term decreases and changes in the timing of fresh water inflow into the bay system.

Salinity during normal to dry periods will not be significantly affected by the selected plan. In dry periods like that which occurred for several months in 1989, Nueces Bay will experience a higher monthly average salinity by 0.1 ppt and Corpus Christi Bay will also be higher by 0.1 parts per thousand (ppt) to 0.4 ppt. In the other months, the average monthly salinity in those areas would be lowered as much as 0.4 ppt by the selected plan. In the Upper Laguna Madre and Baffin Bay, and Aransas Bay and Copano Bay, the salinity will undergo similar small changes.

During wet periods like 1992, the bay system is likely to experience a lower monthly average salinity by 3 to 4 ppt in Nueces Bay and Corpus Christi Bay including the JFK Causeway area. This lower salinity in Corpus Christi Bay will affect Upper Laguna Madre and Aransas Bay as much as 2 to 3 ppt lower and 1 to 2 ppt lower in Baffin Bay and Copano Bay.

Based on these findings changes in channel depth will not cause salinity impacts like those that would be expected in a bay system with a strong salt wedge.

FACILITY REMOVALS/DEEP-DRAFT UTILITY RELOCATIONS ASSOCIATED WITH THE SELECTED PLAN

The Galveston District currently requires pipelines located below deep-draft navigation channels be buried 20 feet below the authorized project depth of the channel (SWGOM 1145-2-15). This requirement was developed taking into consideration several factors, including geotechnical, hydraulic, navigation, maintenance dredging, and pipeline placement method considerations. Exceptions to this requirement can be granted on a case-by-case basis.

During the feasibility phase, 79 pipelines were identified for further consideration. Three of the pipelines identified are located in the existing La Quinta Channel, where there are no proposed modifications. These were removed from further consideration. Exceptions to the 20-foot burial requirement were considered for the remainder of the lines. Several criteria were evaluated in making a determination of exception, including type of product moved through the pipeline, method of burial, type of protection over the existing line, and scour potential in the pipeline locale. After evaluation of these criteria, it was determined that 19 lines that would not meet cover requirements after project construction would be allowed to remain in their current location as an exception to the current policy. The goal of the burial requirements and the evaluation of exceptions were to ensure minimal potential for harm to the environment through impact of lines during routine maintenance and use of the channel system.

Based on the results of further analysis of the remaining 57 pipelines, it was determined that nine of the facilities will not be affected by the Project. These nine lines were either never constructed, already removed, or are currently in the process of being removed or relocated. This leaves 48 pipelines and conduit facilities below the channel that will be affected by the Project. A preliminary evaluation was performed on the 48 lines and each was designated as a removal, relocation, or deep-draft utility relocation. This decision has direct bearing on which parties shall bear the cost of relocating/removing the facility. This designation is detailed in the attached Real Estate Plan.

Based on current law and Administration policy, cost-sharing for the selected plan will be based on Section 101(a)(4) of the Water Resources Development Act of 1986 and the U.S. Army Corps of Engineers policy contained in Policy Guidance Letter 44 (PGL 44) that sets forth the policy regarding the categorization and assignment of costs for actions involving facilities interfering with Federal navigation improvements. Cost sharing requires a determination as to whether the affected facilities will be categorized as "removals," "relocations" or "deep-draft utility relocations," as defined in PGL 44 for each of the pipelines and conduits affected by the Project.

Of the 48 lines identified that will be affected, 40 have been designated as deep-draft utility relocations while eight have been categorized as removals. All of the deep-draft utility relocations and three of the eight removals are located on the CCSC. The other five removals are required as a result of the La Quinta Channel extension.

Of the 43 lines that must be removed/relocated in the CCSC, a majority of the deep-draft utility relocations and all of the removals on the CCSC (34 total) are located in the Inner Harbor reach. Six required deep-draft utility relocations are located in the Lower Bay Reach while three are located in the Upper Bay Reach. No deep-draft utility relocations/relocations/removals are required due to construction of any other project component, including the Entrance Channel of

the CCSC, barge lanes, or ecosystem restoration features. These results are preliminary with final conclusions to be developed following further analysis during the PED phase of the project.

The non-Federal Sponsor lacks the authority to require the pipeline owners to remove lines in a "removal" context for the non-deep draft components of this project. The Sponsor has not requested the State to join in a request for the Government to direct removals. The Sponsor will perform or insure the performance of the removal. Such costs will not be creditable or included in the financial costs of the project cited in this feasibility report, the Chief's Report or the authorizing legislation.

For all deep-draft utility relocations, one-half of the costs shall be borne by the owner of the facility being relocated and one-half of the cost shall be borne by the non-Federal Sponsor. Non-Federal costs for deep-draft utility relocations will be creditable against the non-Federal sponsor's required additional 10 percent repayment requirement detailed in WRDA 86. A line-by-line categorization of these facilities is included in the attached Real Estate Plan. All removals and deep draft utility relocations are located in the open water. There are no bank removal areas affecting removals or relocations.

Any conclusion or categorization contained in this report that an item is a deep draft utility relocation or a removal, to be performed by the Non-Federal Sponsor as part of its LERRD responsibilities is preliminary only. The Government will make a final determination of the relocations necessary for the construction, operation, or maintenance of the Project after further analysis and completion and approval of final attorney's opinions of compensability for each of the impacted utilities and facilities. In the event the future status of a pipeline or facility is converted from a relocation to a removal, such as a pipeline that becomes abandoned, the Non-Federal Sponsor will work with the owner to assure the removal and none of the costs of removal will be creditable against the Sponsor's cost share.

It is the position of the non-Federal sponsor that the Federal government should strictly enforce navigational servitude for this project and the cost to perform the required alterations to remove all pipeline and conduit facilities within the navigation servitude and affected by the Project by lowering, raising, removing or replacing the facilities will be borne 100% by the owner of the facility.

The recommendations of the feasibility report must be in accordance with current law and Administration policy.

HISTORIC RESOURCE IMPACTS ASSOCIATED WITH THE SELECTED PLAN

Cultural resource investigations conducted in conjunction with this study have determined that proposed improvements will impact one significant historic property, the wreck of the SS Mary, which is located immediately adjacent to the Entrance Channel between the Port Aransas jetties. Although the exposed wreckage of the SS Mary is in very poor condition, it is eligible for designation as a State Archaeological Landmark. Proposed channel deepening will adversely affect the wreck of the Mary. Based upon the position of the magnetic anomaly, combined with positions of wreckage, it appears that at least 16 feet of the Mary's stern should lie within the proposed dredging impact area of the channel.

Mitigation options for the Mary have been discussed in consultation with the Texas State Marine Archaeologist and the Texas State Historic Preservation Officer (SHPO). Data recovery is not feasible due to dangerous diving conditions, including currents in excess of 4 knots, proximity to ship traffic and near-zero visibility. Alternative mitigation measures will be pursued, such as the preparation of a Texas maritime history curriculum module for use in public schools and construction of a museum display. A Memorandum of Agreement will be negotiated with the Texas SHPO, which details these alternative mitigation requirements.

IX. PLAN IMPLEMENTATION

DIVISION OF PLAN RESPONSIBILITIES/ COST SHARING REQUIREMENTS

The selected plan would be accomplished at several different cost sharing rates. Project cost sharing for the construction will be as follows:

Navigation Features for CCSC – 52 foot depth

For the locally preferred plan 50% Federal/50% Non-Federal Sponsor

Navigation Features for Barge Shelves

For the NED plan (12-foot depth) 90% Federal/10% Non-Federal Sponsor

Navigation Features for La Quinta Extension – 39 foot depth

For the NED Plan 75% Federal/25% Non-Federal Sponsor

Ecosystem Restoration Features

Additional Costs for NER plan 65% Federal/35% Non-Federal Sponsor

Where environmentally beneficial use of dredged material is the least-cost, environmentally acceptable method of placement (navigation features for CCSC 52-foot depth), it is cost shared as a navigation cost. Components identified as ecosystem restoration features will be cost shared at the 65/35 rate. On each of the project components the non-Federal sponsor will be responsible for payment of 10% of the GNF costs (minus LERR) due within 30 years of the completion of the project. (ER1105-2-100, Exhibit E-1).

Three costs were developed for evaluation of the selected plan. These costs include the Project Cost, NED Investment Cost, and Fully Funded Cost. Project Cost is cost at current levels and does not include expected interest during construction, or expected price escalation totals. Project Cost for all project components is $138,593,670 (Table 17). This total, as well as interest during construction and total average annual costs, are further broken down by project component and detailed in Table 18. This table shows costs and interest for the CCSC, La Quinta Extension, and barge shelves.

Table 17
Project Cost Summary for the Selected Plan

Project Cost	$138,593,670
Interest During Construction	$19,298,863
Deep-Draft Utility Relocations	$26,031,294
Removals	$5,022,160
Bulkhead, Berthing Modifications	$49,672,500
NED Investment Cost	$245,306,241
Average Annual Costs	
Amortization	$15,835,495
O&M	$2,247,188
Total Average Annual Costs	$18,082,683

Table 18
Project and NED Investment Cost Summary

	CCSC	La Quinta Extension	Barge Shelves	Totals
Project Cost	$112,540,105	$25,143,937	$909,628	$138,593,670
Months to Construct	63	7	7	
Interest During Construction	$18,913,063	$372,330	$13,470	$19,298,863
Deep-Draft Utility Relocations	$26,031,294	$0	$0	$26,031,294
Removals	$1,130,895	$3,891,265	$0	$5,022,160
Bulkhead, Berthing Modifications	$8,677,500	$40,995,000	$0	$49,672,500
Interest During Construction for Other & Associated Costs	$6,023,082	$664,673		$6,687,755
Total Other & Associated Costs	$41,862,771	$45,550,938		$87,413,709
NED Investment Cost	$173,315,939	$71,067,205	$923,098	$245,306,241
Average Annual Cost Including Incremental O&M	$12,858,134	$5,137,977	$86,572	$18,082,683
Annual Benefits	$32,606,650	$9,264,460	$134,157	$42,005,267
Net Excess Benefits	$19,748,516	$4,126,483	$47,585	$23,922,585
B/C Ratio	2.5	1.8	1.5	

Project Cost, interest during construction, relocation/removal/deep-draft utility relocation costs, and bulkhead and berthing facility modification costs were combined to develop NED Investment Costs for each project component (Table 18). These costs were then used to update net excess benefit totals and B/C ratios. These costs differ from those in the earlier screening process due to the availability of more detailed information developed after the initial screening was performed.

Project Costs and price escalation, calculated by estimating mid-point of the proposed construction contracts, are combined to create the Fully Funded Cost. These costs are separated into expected Federal and non-Federal shares and detailed in Table 19 for the CCSC deepening, Table 20 for the extension of the La Quinta Channel, and Table 21 for the barge shelves.

Table 19
CCSC 52-Foot Project Fully Funded Cost Allocation

General Navigation Features (GNF)	Non-Fed Costs	Federal Costs	Total Costs
Channel Deepening and Widening	$41,264,073	$41,264,073	$82,528,145
Placement Area Levee Construction/Drop Structures	$1,058,286	$1,058,286	$2,116,571
Beneficial Use Sites (least cost)	$10,931,019	$10,931,019	$21,862,038
Historic Resources Mitigation	$0	$ 213,240	$213,240
Engineering and Design	$3,090,545	$3,090,545	$6,181,089
Construction Management	$3,366,530	$3,366,530	$6,733,059
Sub-Total GNF	$59,710,451	$59,923,691	$119,634,142
Ecosystem Restoration Features (BU L)			
Geotextile Fabric	$57,097	$106,038	$163,135
Rip Rap and Blanket Stone	$938,978	$1,743,815	$2,682,793
Sub-Total Ecosystem Restoration	$996,075	$1,849,853	$2,845,928
Fully Funded Cost	$60,706,526	$61,773,544	$122,480,070

Table 20
La Quinta Extension Fully Funded Cost Allocation

General Navigation Features (GNF):	Non Federal	Federal Cost	Total Cost
Dredging for Extension	$4,322,957	$12,968,871	$17,291,828
Placement Area Levee Construction/Drop Structures	$244,594	$733,782	$978,376
Beneficial Use Sites (least cost)	$1,081,553	$3,244,660	$4,326,213
Environmental Mitigation	$17,270	$51,810	$69,080
Engineering and Design	$304,110	$912,330	$1,216,440
Construction Management	$284,263	$852,788	$1,137,050
Sub-Total GNF	$6,254,747	$18,764,240	$25,018,987
Ecosystem Restoration Features (BU P)			
Geotextile Fabric	$0	$0	$0
Rip Rap and Blanket Stone	$640,696	$1,189,864	$1,830,560
	$640,696	$1,189,864	$1,830,560
Fully Funded Cost	$6,895,443	$19,954,104	$26,849,547

Table 21
Barge Shelf Fully Funded Cost Allocation

General Navigation Features	Non-Federal	Federal Cost	Total Cost
Dredging - Barge Shelves	$84,843	$763,588	$848,431
Engineering and Design	$6,402	$57,621	$64,023
Construction Management	$5,984	$53,860	$59,845
Sub-Total GNF	$97,230	$875,069	$972,299
Fully Funded Cost	$97,230	$875,069	$972,299

Section 101 of Public Law 99-662 requires that the non-Federal sponsor pay an additional amount equal to 10 percent of the total construction cost for the general navigation features. This may be paid over a period of 30 years and land, easement, right-of-way, and relocation (LERR) costs paid by the non-Federal sponsor may be credited against it. To determine the amount of credit, GNF costs were developed utilizing current dollar amounts (fully funded numbers minus escalation). These totals are detailed in Tables 22, 23 and 24. Totals for real estate, relocations, removals, and other associated costs are included.

Actual cost of deep-draft utility relocations borne by the non-Federal sponsor, up to 50 percent of the total cost of the deep-draft utility relocations, is also creditable against the additional 10 percent share of GNF. However, for actions categorized as removals, non-Federal sponsor costs are not creditable against the additional 10 percent share of GNF.

Total GNF for all project components, as well as non-Federal sponsor credit, which includes real estate costs associated with dredged material placement areas and 50 percent of the cost of the deep-draft utility relocations, is detailed in Table 25. Removals costs, which are not creditable against the additional 10 share of GNF, are not included in this table. The non-Federal sponsor creditable costs of $18,811,598 exceed the expected additional payment of $12,892,261.

Associated costs for berthing area dredging does not include expected O&M costs for those areas. The costs associated with providing additional capacity in placement areas to accommodate O&M material dredged from berthing areas is 100% non-Federal sponsor. Expected cost sharing for all project components is compliant with PGL 47, *Cost Sharing for Dredged Material Disposal Facilities and Dredged Material Disposal Facility Partnerships.*

Table 22
CCSC 52-Foot Cost Allocation

	Non-Fed Costs	Federal Costs	Total Costs
General Navigation Features (GNF)			
Channel Deepening and Widening	$35,884,722	$35,884,722	$71,769,443
Placement Area Levee Construction/Drop Structures	$897,000	$897,000	$1,794,000
Beneficial Use Sites (least cost)	$9,624,628	$9,624,628	$19,249,255
Historic Resources Mitigation	$0	$ 213,240	$213,240
Engineering and Design	$2,815,998	$2,815,998	$5,631,996
Construction Management	$2,971,862	$2,971,862	$5,943,724
Sub-Total GNF	$52,194,209	$52,407,449	$104,601,658
Ecosystem Restoration Features (BU L)			
Geotextile Fabric	$51,686	$95,989	$147,675
Rip Rap and Blanket Stone	$849,995	$1,578,562	$2,428,557
Sub-Total Ecosystem Restoration	$901,681	$1,674,551	$2,576,232
Lands,Easements,Real Estate and Rights-of-Way(LERR)			
Real Estate	$5,774,500	$101,250	$5,875,750
Sub-Total LERR	$5,774,500	$101,250	$5,875,750
Deep-Draft Utility Relocations			
Non-Federal Sponsor Costs	$13,015,647	$0	$13,015,647
Utility Owner Costs	$13,015,647	$0	$13,015,647
Sub-Total Relocations	$26,031,294	$0	$26,031,294
Pipeline Removals	$1,130,895	$0	$1,130,895
Sub-Total Removals	$1,130,895	$0	$1,130,895
Associated Non-Federal Costs:			
Berthing Areas Dredging, Docks, Bulkheads, etc	$8,677,500	--	$8,677,500
Sub-Total Associated	$8,677,500	$0	$8,677,500
Current Cost	$94,710,079	$54,183,250	$148,893,329

The maintenance of the project features will be funded through annual appropriations of the Operations and Maintenance program. Construction General funding will fund all project construction components. The actual amounts would vary on a year-to-year basis because of variability in the volume of material removed during each dredging cycle and the variability of the cycles.

Table 23
La Quinta Extension Cost Allocation

General Navigation Features (GNF):	Non Federal	Federal Cost	Total Cost
Dredging for Extension	$4,029,671	$12,089,013	$16,118,684
Placement Area Levee Construction/Drop Structures	$228,000	$684,000	$912,000
Beneficial Use Sites (least cost)	$1,008,177	$3,024,530	$4,032,706
Environmental Mitigation	$16,098	$48,295	$64,393
Engineering and Design	$298,356	$895,067	$1,193,423
Construction Management	$272,189	$816,566	$1,088,755
Sub-Total GNF	$5,852,490	$17,557,471	$23,409,961
Ecosystem Restoration Features (BU P)			
Geotextile Fabric	$0	$0	$0
Rip Rap and Blanket Stone	$597,229	$1,109,139	$1,706,368
Sub-Total Ecosystem Restoration	$597,229	$1,109,139	$1,706,368
Lands,Easements,Real Estate and Rights-of Way(LERR)			
Real Estate	$8,919	$17,500	$26,419
Sub-Total LERR	$8,919	$17,500	$26,419
Pipeline Removals	$3,891,265	$0	$3,891,265
Sub-Total Removals	$3,891,265	$0	$3,891,265
Associated Non-Federal Costs:			
Berthing Areas Dredging, Docks, Bulkheads, etc (Included in BCR)	$40,995,000	--	$40,995,000
Sub-Total Associated	$40,995,000	$0	$40,995,000
Current Cost	$51,344,903	$18,684,110	$70,029,013

Table 24
Barge Shelf Cost Allocation

General Navigation Features	Non-Federal	Federal Cost	Total Cost
Dredging - Barge Shelves	$79,087	$711,784	$790,871
Engineering and Design	$6,281	$56,531	$62,812
Construction Management	$5,730	$51,573	$57,303
Sub-Total GNF	$91,099	$819,887	$910,986
Current Cost	$91,099	$819,887	$910,986

Table 25 Total GNF Costs and Credits	
Total Cost GNF	$128,922,605
10% of GNF [a]	$12,892,261
Creditable Deep-Draft Utility Relocation Costs	$13,015,647
Creditable Real Estate Costs	$5,795,951
Total Non-Federal Sponsor Creditable Costs	$18,811,598
Creditable Difference	$(5,919,337)

a – Maximum amount creditable to non-Federal sponsor

NON-FEDERAL SPONSOR VIEWS

The non-Federal sponsor for the existing project, the Port of Corpus Christi Authority, has actively participated throughout the planning process. Their primary concern has been inclusion of the project authorization in the Water Resources Development Act of 2003. The Port of Corpus Christi Authority is supportive of the selected plan and has indicated an interest in beginning construction as soon as possible.

X. SUMMARY OF COORDINATION, PUBLIC VIEWS, AND COMMENTS

Public input has been important in the overall planning process to assure that plans considered and developed were compatible with community and regional objectives. The primary purposes of public involvement are: (1) to allow the public the opportunity to provide timely information to the USACE so that developed plans will reflect their preferences to the greatest extent possible, and (2) to provide a method by which the USACE can inform the public so that those who choose to participate in the project formulation and the planning process can do so with a relatively complete understanding about the issues, opportunities, and consequences associated with a study.

The various measures used during this study to assure open, two-way public communication included public notices, newsletters, media interviews, and meetings with various interested parties.

The Feasibility phase was initiated with issuance of a Public Notice in July 1999, which presented a summary of the past and planned study activities for this study. This notice also discussed the study process, the specific problems in the two channels, and various alternatives to be investigated. It invited all interested parties to provide input to the study beginning with a Public Meeting held in August 1999. Nine public meetings followed to update the public about the progression of the project and to solicit input. A series of newsletters was also sent to over 1,400 interested parties as well as individuals who attended meetings on the project. Other various forms of outreach utilized during this project included early regulatory agency coordination, RACT/Workgroup meetings, individual contacts, a toll-free 800 number, Spanish voice mailbox, web site postings, press releases, and comment forms.

A Feasibility Scoping Meeting was held in Corpus Christi, Texas on May 11, 2000. USACE Headquarters and Southwest Division personnel, as well as Port of Corpus Christi Authority representatives, were in attendance to also discuss the study process, the specific problems in the Corpus Christi and La Quinta Channels, and various alternatives to be investigated. To update Headquarters and Division personnel, a In-Progress Review meeting was held in Corpus Christi on August 28 and 29, 2001. As a follow-up to this meeting, an Alternatives Formulation Briefing was held by teleconference on February 6, 2002, to discuss final plan selection.

Studies were coordinated with U.S. Fish and Wildlife Service, Texas Parks and Wildlife Department, Texas Commission on Environmental Quality, National Marine Fisheries Service, Texas State Historic Preservation Officer, and other Federal and State resource agencies. USFWS coordination began in July 2001, and the draft Coordination Act Report was completed

in March 2002. Regular RACT and workgroup meetings were held with all agency members. Workgroups met to evaluate hydrodynamic and salinity modeling, beneficial use opportunities, shoreline erosion, contaminants, mitigation, and cumulative impacts. The meetings provided guidance to insure that minimal impacts would occur with all project components and that dredged material was utilized in a beneficial manner.

XI. RECOMMENDATIONS

It is recommended that the existing projects for the Corpus Christi Ship Channel, Texas, authorized by the Rivers and Harbors Act of 1968, be modified generally as described in this report as the Selected Plan, with such modifications as in the discretion of the Chief of Engineers may be advisable, and subject to cost-sharing and financing arrangements satisfactory to the President and the Congress, to provide deep-draft channel improvements to the Port of Corpus Christi from the enlargement and continued maintenance of a portion of the Corpus Christi Ship Channel.

The Project Cost of all project components, minus inflation and interest during construction, totals $138,594,000. The NED Investment Cost of all components, totals $245,306,000, and includes $19,299,000 in interest during construction for project components, $26,031,000 in deep-draft utility relocation costs, $5,022,000 in removal costs, $49,672,500 in bulkhead and berthing modification costs, and $6,688,000 in interest during construction for associated activities. Total average annual costs for the project are $18,083,000. Fully Funded Cost of the projects, which includes Project Costs and expected escalation totals, is $150,302,000.

These recommendations are made with the provision that, prior to implementation of the recommended improvements, the non-Federal Sponsor shall enter into binding agreements with the Federal government to comply with the following requirements:

The Port of Corpus Christi Authority shall:

a. Enter into an agreement which provides, prior to execution of the project cooperation agreement, 25 percent of design costs;

b. Provide, during construction, any additional funds needed to cover the non-federal share of design costs;

c. Provide, during the period of construction, a cash contribution equal to the following percentages of the total cost of construction of the general navigation features (which include the construction of land-based and aquatic dredged material disposal facilities that are necessary for the disposal of dredged material required for project construction, operation, or maintenance of the navigation improvements and for which a contract for the federal facility's construction or improvement was not awarded on or before October 12, 1996;):

(1) 10 percent of the costs attributable to dredging to a depth not in excess of 20 feet; plus

(2) 25 percent of the costs attributable to dredging to a depth in excess of 20 feet, but not in excess of 45 feet; plus

(3) 50 percent of the costs attributable to dredging to a depth in excess of 45 feet;

d. Pay with interest, over a period not to exceed 30 years following completion of the period of construction of the project, up to an additional 10 percent of the total cost of construction of general navigation features. The value of lands, easements, rights-of-way, relocations, and deep-draft utility relocations provided by the non-Federal sponsor for the general navigation features, described below, may be credited toward this required payment. The value of deep-draft utility relocations for which credit may be afforded shall be that portion borne by the non-Federal sponsor, but not to exceed 50 percent, of deep-draft utility relocation costs. If the amount of credit equals or exceeds 10 percent of the total cost of construction of the general navigation features, the non-Federal sponsor shall not be required to make any contribution under this paragraph, nor shall it be entitled to any refund for the value of lands, easements, rights-of-way, relocations, and deep-draft utility relocations in excess of 10 percent of the total cost of construction of the general navigation features;

e. Provide all lands, easements, and rights-of-way, and perform or ensure the performance of all relocations and deep-draft utility relocations determined by the Federal Government to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features (including all lands, easements, and rights-of-way, relocations, and deep-draft utility relocations necessary for dredged material disposal facilities).

f. Provide, operate, maintain, repair, replace, and rehabilitate, at its own expense, the local service facilities (Oil Docks 1, 4, 7, 8, 11, Bulk Dock 2, and Corpus Christi Public Elevator); in a manner compatible with the project's authorized purposes and in accordance with applicable Federal and State laws and regulations and any specific directions prescribed by the Federal Government;

g. Accomplish all removals determined necessary by the Federal Government other than those removals specifically assigned to the Federal Government;

h. Provide 35 percent of the separable project costs allocated to ecosystem restoration as further specified below:

(1) Provide all lands, easements, and rights-of-way, including suitable borrow and dredged or excavated material disposal areas, and perform or assure the performance of all relocations determined by the Government to be necessary for the construction, operation, and maintenance of the project;

(2) Provide or pay to the Government the cost of providing all retaining dikes, wasteweirs, bulkheads, and embankments, including all monitoring features and stilling basins, that may be required at any dredged or excavated material disposal areas required for the construction, operation, and maintenance of the project; and

(3) Provide, during construction, any additional costs as necessary to make its total contribution equal to 35 percent of the separable project costs allocated to ecosystem restoration.

i. For so long as the project remains authorized, operate, maintain, repair, replace, and rehabilitate the ecosystem restoration portion of the project, or functional ecosystem restoration features of the project, at no cost to the Government, in accordance with applicable Federal and State laws and any specific directions prescribed by the Government.

j. Assume responsibility for operating, maintaining, replacing, repairing, and rehabilitating (OMRR&R) the ecosystem restoration portion of the project or any functional ecosystem restoration features of the project, including mitigation features without cost to the Government, in a manner compatible with the project's authorized purpose and in accordance with applicable Federal and State laws and specific directions prescribed by the Government in the OMRR&R manual and any subsequent amendments thereto.

k. Give the Federal Government a right to enter, at reasonable times and in a reasonable manner, upon property that the non-Federal sponsor owns or controls for access to the project for the purpose of inspection, and, if necessary, for the purpose of operating, maintaining, repairing, replacing, and rehabilitating the general navigation features;

l. Hold and save the United States free from all damages arising from the construction, operation, maintenance, repair, replacement, and rehabilitation of the project, any betterments, and the local service facilities, except for damages due to the fault or negligence of the United States or its contractors;

m. Keep, and maintain books, records, documents, and other evidence pertaining to costs and expenses incurred pursuant to the project, for a minimum of 3 years after completion of the accounting for which such books, records, documents, and other evidence is required, to the

extent and in such detail as will properly reflect total cost of construction of the general navigation features, and in accordance with the standards for financial management systems set forth in the Uniform Administrative Requirements for Grants and Cooperative Agreements to State and local governments at 32 CFR, Section 33.20;

n. Perform, or cause to be performed, any investigations for hazardous substances as are determined necessary to identify the existence and extent of any hazardous substances regulated under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), 42 U.S.C. 9601-9675, that may exist in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, or rehabilitation of the general navigation features. However, for lands that the Government determines to be subject to the navigation servitude, only the Government shall perform such investigation unless the Federal Government provides the non-Federal sponsor with prior specific written direction, in which case the non-Federal sponsor shall perform such investigations in accordance with such written direction;

o. Assume complete financial responsibility, as between the Federal Government and the non-Federal sponsor, for all necessary cleanup and response costs of any CERCLA regulated materials located in, on, or under lands, easements, or rights-of-way that the Federal Government determines to be necessary for the construction, operation, maintenance, repair, replacement, and rehabilitation of the project;

p. To the maximum extent practicable, perform its obligations in a manner that will not cause liability to arise under CERCLA;

q. Comply with Section 221 of Public Law 91-611, Flood Control Act of 1970, as amended, and Section 103 of the Water Resources Development Act of 1986, Public Law 99-662, as amended, which provides that the Secretary of the Army shall not commence the construction of any water resources project or separable element thereof, until the non-Federal sponsor has entered into a written agreement to furnish its required cooperation for the project or separable element.

r. Comply with the applicable provisions of the Uniform Relocation Assistance and Real Property Acquisition Policies Act of 1970, Public Law 91-646, as amended by Title IV of the Surface Transportation and Uniform Relocation Assistance Act of 1987, and the Uniform Regulations contained in 49 CFR Part 24, in acquiring lands, easements, and rights-of-way, required for construction, operation, maintenance, repair, replacement, and rehabilitation of the general navigation features, and inform all affected persons of applicable benefits, policies, and procedures in connection with said act;

s. Comply with all applicable Federal and State laws and regulations, including, but not limited to, Section 601 of the Civil Rights Act of 1964, Public Law 88-352 (42 U.S.C. 2000d), and Department of Defense Directive 5500.11 issued pursuant thereto, as well as Army Regulation 600-7, entitled "Nondiscrimination on the Basis of Handicap in Programs and Activities Assisted or Conducted by the Department of the Army." The State is also required to comply with all applicable Federal labor standards requirements including, but not limited to, the Davis-Bacon Act (40 USC 3144 *et seq*), the Contract Work Hours and Safety Standards Act (40 USC 3701 *et seq*), and the Copeland Anti-Kickback Act (40 USC 3145 *et seq*).

t. Provide the non-Federal share of that portion of the costs of mitigation and data recovery activities associated with historic preservation, that are in excess of 1 percent of the total amount authorized to be appropriated for the project, in accordance with the cost sharing provisions of the agreement;

u. In the case of a deep-draft harbor, provide 50 percent of the excess cost of operation and maintenance of the project over that cost which the Secretary determines would be incurred for operation and maintenance if the project had a depth of 45 feet; and

v. Prevent obstructions of or encroachments on the project (including prescribing and enforcing regulations to prevent such obstructions or encroachments) which might reduce the ecosystem restoration, hinder its operation and maintenance, or interfere with its proper function, such as any new development on project lands or the addition of facilities which would degrade the benefits of the project.

w. Do not use Federal funds to meet the non-Federal sponsor's share of total project costs unless the Federal granting agency verifies in writing that the expenditure of such funds is authorized.

x. The container facilities on the La Quinta Channel will be substantially completed prior to the initiation of construction of the 39-foot La Quinta Channel Extension portion of the project.

Construction of the recommended channel improvements is estimated to take 5 years to complete. During this period, the Government and the Sponsors shall diligently maintain the projects at their previously authorized dimensions according to the previous cooperation agreement. Maintenance materials that have accumulated in the channels at the time that "before dredging" profiles are taken for construction payment shall be considered as new work material and cost-shared according to the new cooperation agreement. Any dredging in a construction

contract reach after the improvements have been completed and the construction contract closed will be considered to be maintenance material and cost-shared according to the new agreement.

Those portions of the projects for the Corpus Christi Ship and La Quinta Channels that are deepened or newly created shall be operated and maintained according to the terms and provision of the new agreements. All other portions of the existing projects for the La Quinta Channel shall continue to be operated and maintained according to the existing agreement applicable to that portion of the channel.

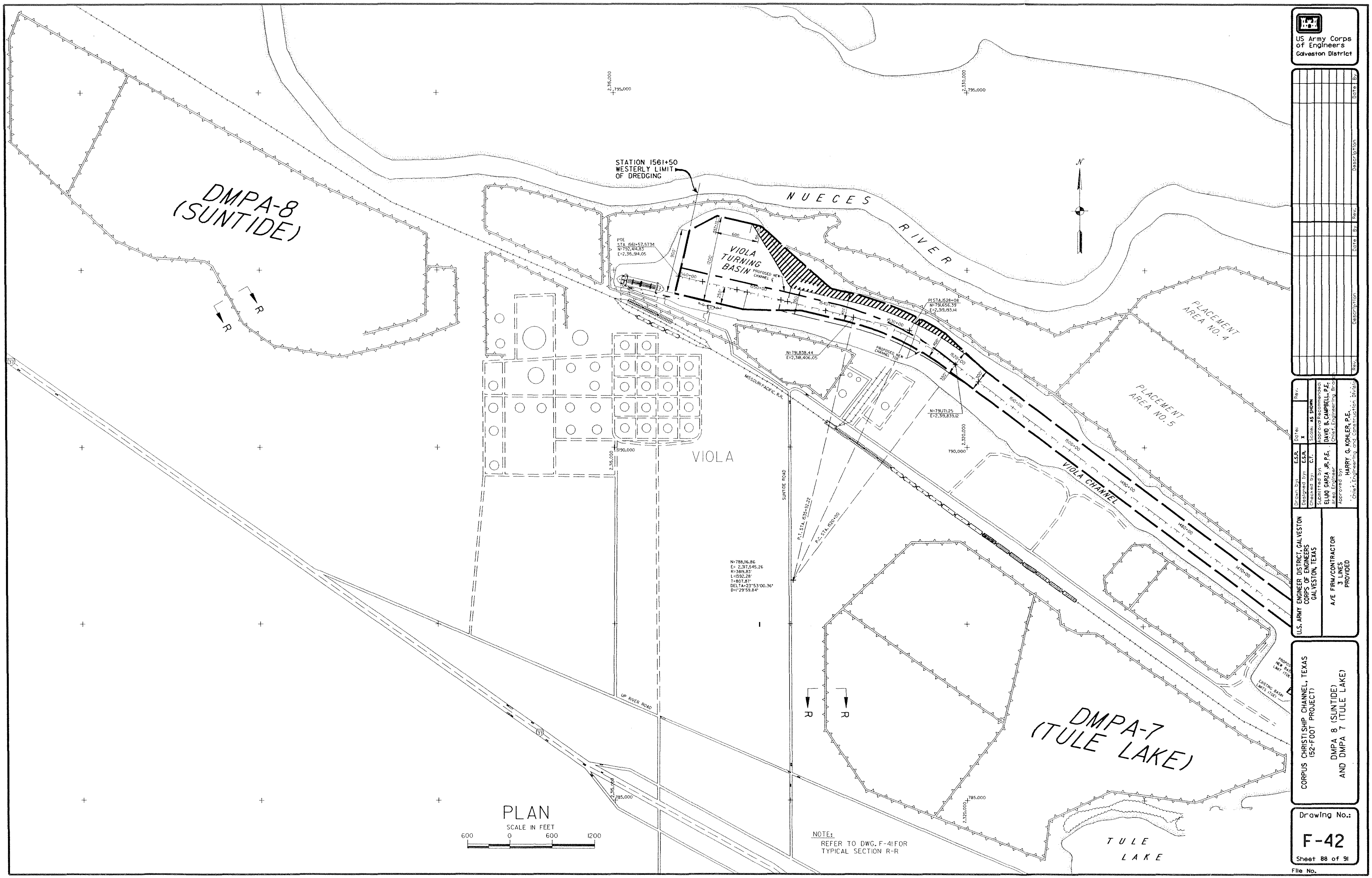
The recommendations contained herein reflect removal of pipelines, in most cases, with less than 20 feet of cover after project construction over the width of the channel plus an additional 25 feet of width on each channel edge. It has been proposed that some of the lines remain at their current depth based on several criteria, including type of product transported in the line, whether the line has a casing, type of material the line is buried in, and scour in the portion of the channel the line is located in. Based on these considerations, 19 pipelines that will not have 20 feet of cover after project construction will remain at their current depth. Additional consideration will be given to cover requirements during design of the project. Should less cover be considered adequate, the District Engineer will notify the affected pipeline owners that they will not need to remove their pipelines. Should the decision be made that more cover is needed on lines not previously scheduled for removal, the District Engineer will update the project economic evaluation to reflect the additional associated costs and submit the economic update to the Chief of Engineers for approval prior to advertising the first construction contract and notify the affected pipeline owners that they will have to remove these pipelines. Since pipeline removals are not a project cost, no changes to the Baseline Cost Estimate or Sponsor and Federal Cost-sharing will be required for either situation, however, modifications would be made to the cost allocation tables found in Section IX of this report.

The recommendations contained herein reflect the information available at this time and current Departmental policies governing formulation of individual projects. They do not reflect program and budgeting priorities inherent in the formulation of a national Civil Works construction program nor the perspective of higher review levels with the Executive Branch. Consequently, the recommendations may be modified before they are transmitted to the Congress as proposals for

authorizations and implementation funding. However, prior to transmittal to the Congress, the non-Federal sponsor, the State, interested Federal agencies, and other parties will be advised of any modifications and will be afforded an opportunity to comment further.

3 April 2003
Date

Leonard D. Waterworth
Colonel, Corps of Engineers
District Engineer



DMPA-8
(SUNTIDE)
STATION 1561+50
WESTERLY LIMIT
OF DREDGING
NUECES RIVER
VIOLA
TURNING
BASIN
PLACEMENT
AREA NO. 4
PLACEMENT
AREA NO. 5
VIOLA
VIOLA CHANNEL
MISSOURI PACIFIC R.R.
SUNTIDE ROAD
UP RIVER ROAD
DMPA-7
(TULE LAKE)
TULE
LAKE
PLAN
SCALE IN FEET
600 0 600 1200
NOTE:
REFER TO DWG. F-41 FOR
TYPICAL SECTION R-R
US Army Corps
of Engineers
Galveston District
U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS
A/E FIRM/CONTRACTOR
3 LINES
PROVIDED
CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
DMPA 8 (SUNTIDE)
AND DMPA 7 (TULE LAKE)
Drawing No.:
F-42
Sheet 88 of 91
File No.

Plate 1

US Army Corps of Engineers
Galveston District

STATION 1561+50
WESTERLY LIMIT
OF DREDGING

NUECES RIVER

VIOLA TURNING BASIN

VIOLA

VIOLA CHANNEL

PLACEMENT AREA NO. 4

PLACEMENT AREA NO. 5

TULE LAKE TURNING BASIN

DMPA-7
(TULE LAKE)

TULE LAKE

SOUTH SHORE PLACEMENT AREA CELL 'C'

TULE LAKE CHANNEL

MATCH LINE STA. 1350+00

NUECES BAY

SUNTIDE ROAD

UP RIVER ROAD

SOUTHERN MINERALS ROAD

CORN PRODUCTS REFINING COMPANY

N

PLAN
SCALE IN FEET
800 0 800 1600

No.	Description	Date	By
Rev.	Description	Date	By

Drawn by: E.S.R. | Date: X
Designed by: E.S.R. | Scales: AS SHOWN
Checked by: C.T. | Approved Recommended:
Submitted by: ELIXO CARZA JR, P.E. Area Engineer | DAVID B. CAMPBELL, P.E. Chief, Engineering Division
Approved by: HARRY G. KOHLER, P.E. Chief, Engineering and Construction Division

U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

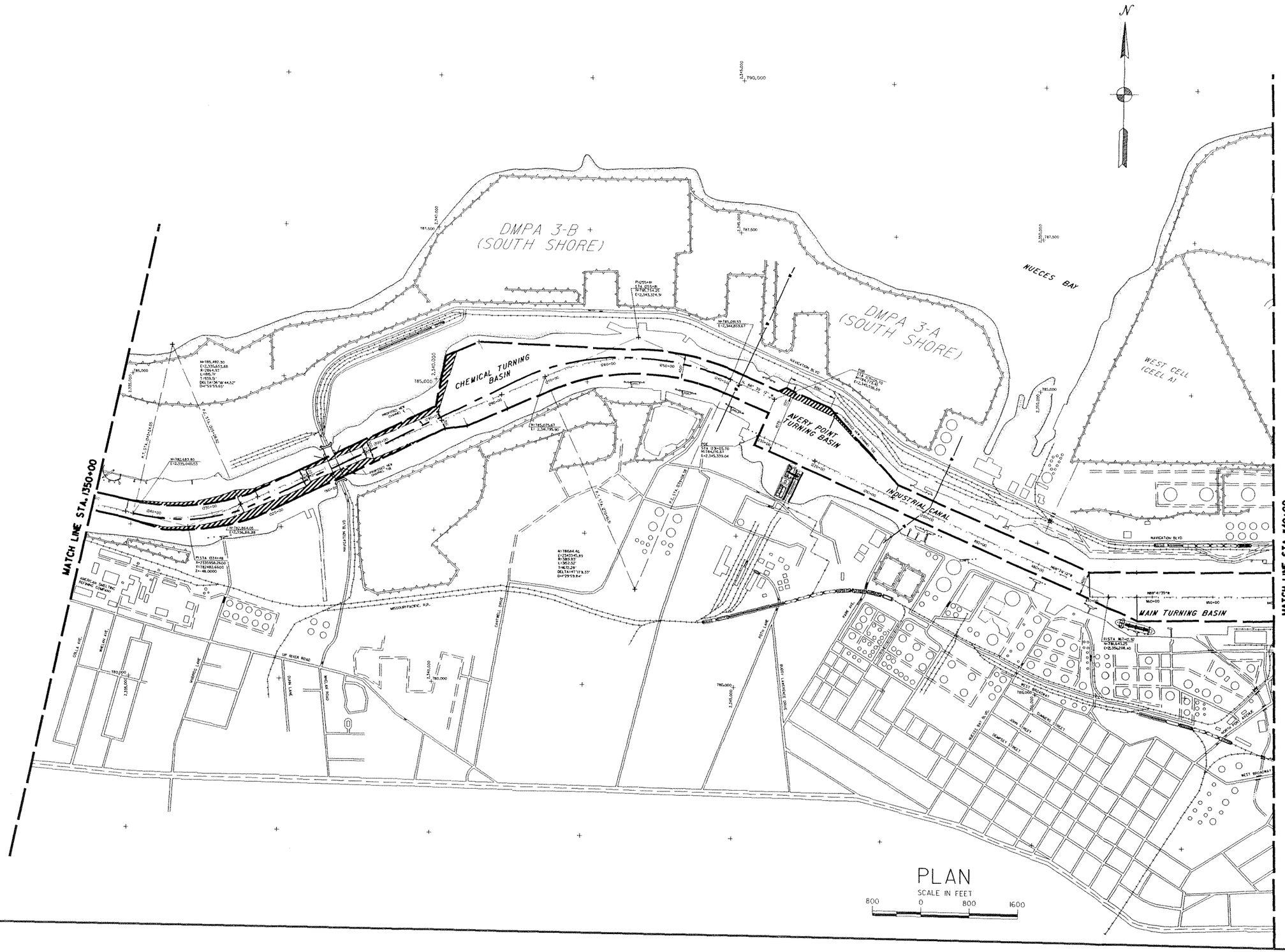
A/E FIRM (CONTRACTOR)
AS-BUILTS
NOT
PROVIDED

CORPUS CHRISTI SHIP CHANNEL, TEXAS
52-FOOT PROJECT)
ENTRANCE CHANNEL
TO VIOLA TURNING BASIN

DREDGING PLAN
STA. 1350+00 TO STA. 1561+57.5732

Drawing No.: C-1
Sheet of 91
File No.

Plate 2



US Army Corps of Engineers
Galveston District

Rev.	Description	Date	By

Drawn by:	E.S.B.	Job no.	
Designed by:	E.S.B.		X
Checked by:	C.T.	Scales:	AS SHOWN
Submitted by:		Approved/Recommended:	
ELIJIO GARZA JR, P.E.		DAVID B. CAMPBELL, P.E.	
Area Engineer		Chief, Engineering Branch	
Approved by:		HARRY G. KOHLER, P.E.	
Chief, Engineering and Construction Division			

U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

A/E FIRM/CONTRACTOR
3 LINES
PROVIDED

CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
ENTRANCE CHANNEL
TO VIOLA TURNING BASIN

DREDGING PLAN
STA. 1140+00 TO STA. 1350+00

Drawing No.:
C-2
Sheet of 91

File No.

Plate 3

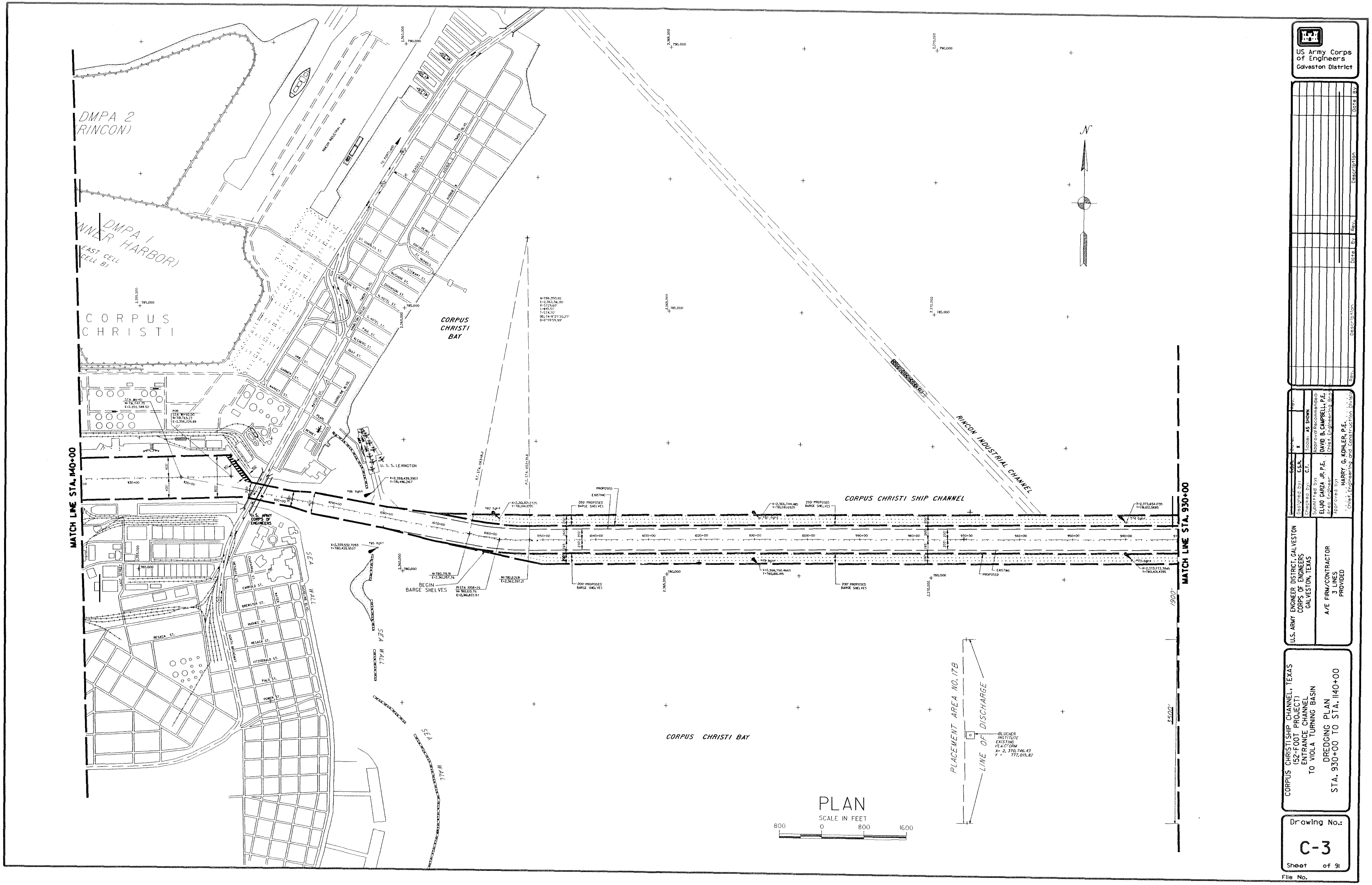

US Army Corps of Engineers
Galveston District
DMPA 2 (RINCON)
DMPA 1 (INNER HARBOR)
EAST CELL
CELL B1
CORPUS CHRISTI
CORPUS CHRISTI BAY
RINCON INDUSTRIAL CHANNEL
CORPUS CHRISTI SHIP CHANNEL
U. S. S. LEXINGTON
U.S. ARMY CORPS OF ENGINEERS
SEA WALL
BEGIN BARGE SHELVES
200' PROPOSED BARGE SHELVES
PROPOSED
EXISTING
MATCH LINE STA. 1140+00
MATCH LINE STA. 930+00
PLACEMENT AREA NO. 17B
LINE OF DISCHARGE
BLUCHER INSTITUTE EXISTING PLATFORM
X= 2, 370,746.43
Y = 777,015.82
1900'
3500'
N
PLAN
SCALE IN FEET
800 0 800 1600
Designed by: E.S.R.
Checked by: C.T.
Scale: AS SHOWN
Submitted by: ELIAS GARZA JR, P.E.
Approval Recommended: DAVID B. CAMPBELL, P.E.
Chief, Engineering Branch
Approved by: HARRY G. KOHLER, P.E.
Chief, Engineering and Construction Division
U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS
A/E FIRM/CONTRACTOR
3 LINES PROVIDED
CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
ENTRANCE CHANNEL TO VIOLA TURNING BASIN
DREDGING PLAN
STA. 930+00 TO STA. 1140+00
Drawing No.:
C-3
Sheet of 91
File No.
Rev. Date By Description

Plate 4

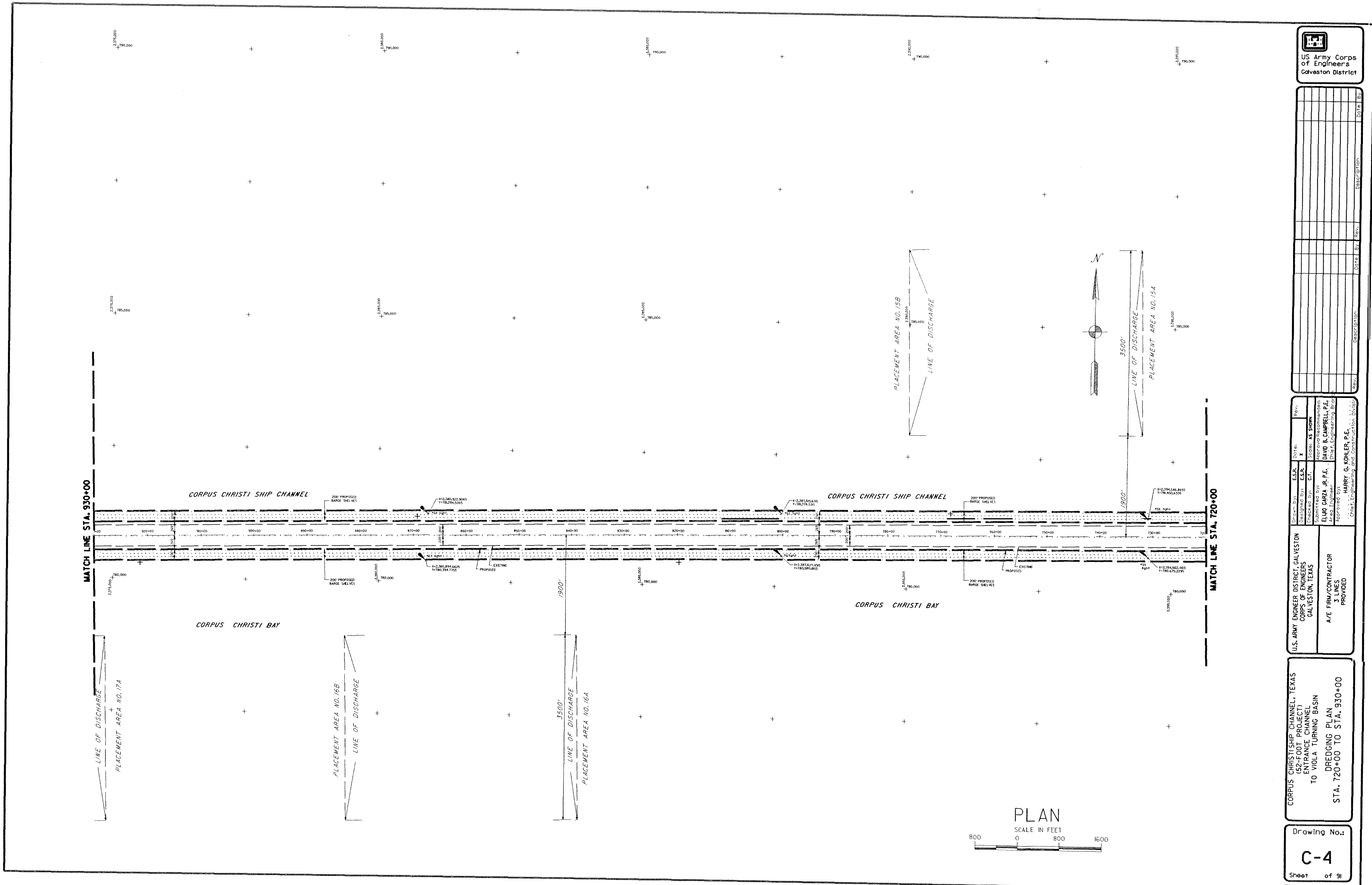

US Army Corps of Engineers
Galveston District
MATCH LINE STA. 930+00
MATCH LINE STA. 720+00
CORPUS CHRISTI SHIP CHANNEL
CORPUS CHRISTI BAY
200' PROPOSED BARGE SHELVES
EXISTING
PROPOSED
1900'
3500'
LINE OF DISCHARGE
PLACEMENT AREA NO. 17A
PLACEMENT AREA NO. 16B
PLACEMENT AREA NO. 16A
PLACEMENT AREA NO. 15B
PLACEMENT AREA NO. 15A
N
PLAN
SCALE IN FEET
800 0 800 1600
Drawn by: E.S.R.
Designed by: E.S.R.
Checked by: C.T.
Date: X
Scale: AS SHOWN
Rev.
Submitted by: ELOJO GARZA JR, P.E. Area Engineer
Approval Recommended: DAVID B. CAMPBELL, P.E. Chief, Engineering Branch
Approved by: HARRY G. KOHLER, P.E. Chief, Engineering and Construction Division
U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS
A/E FIRM/CONTRACTOR
3 LINES
PROVIDED
CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
ENTRANCE CHANNEL
TO VIOLA TURNING BASIN
DREDGING PLAN
STA. 720+00 TO STA. 930+00
Drawing No.:
C-4
Sheet of 91
File No.

Plate 5

US Army Corps of Engineers
Galveston District

CORPUS CHRISTI BAY

CHANNEL TO LA QUINTA

INGLESIDE COVE

PLACEMENT AREA NO.11

INGLESIDE POINT

INGLESIDE ON-THE-BAY

PLACEMENT AREA NO.14A

LINE OF DISCHARGE

3500'

1900'

PLACEMENT AREA NO.14B

LINE OF DISCHARGE

BU 5 (SITE C-Q)

BU 9 (SITE P)

BU 4 (SITE S)

DMPA 10

SB-10

SB-9

MATCH LINE STA. 720+00

MATCH LINE STA. 500+00

CORPUS CHRISTI SHIP CHANNEL

CORPUS CHRISTI BAY

200' PROPOSED BARGE SHELVES

EXISTING

PROPOSED

BEGIN OF BARGE SHELVES

PLAN
SCALE IN FEET
800 0 800 1600

Rev.	Description	Date	By

Drawn by:	E.S.R.	Date: X	Rev.
Designed by:	E.S.R.	Scale: AS SHOWN	
Checked by:	C.T.	Approval Recommended:	
Submitted by:	ELIJIO GARZA JR, P.E.	DAVID B. CAMPBELL, P.E.	
Area Engineer		Chief, Engineering Branch	
Approved by:	HARRY G. KOHLER, P.E.		
Chief, Engineering and Construction Division			

U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

A/E FIRM/CONTRACTOR
3 LINES
PROVIDED

CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
ENTRANCE CHANNEL
TO VIOLA TURNING BASIN
DREDGING PLAN
STA. 500+00 TO STA. 720+00

Drawing No.:
C-5
Sheet of 91

File No.

Plate 6

HARBOR CITY

U.S.NAVAL STATION INGLESIDE, TEXAS

PORT INGLESIDE

RED FISH COVE

DAGGER ISLAND

PLACEMENT AREA NO.162

GULF INTRACOASTAL WATERWAY

CORPUS CHRISTI SHIP CHANNEL

MATCH LINE STA. 280+00

MATCH LINE STA. 500+00

BU 2 (SITE 1)

CORPUS CHRISTI BAY

BU 7 (PELICAN)

PLACEMENT AREA NO.164

PLACEMENT AREA NO.165

BU 3 (SITE R)

SB-12

SB-13

N

S

PLAN

SCALE IN FEET

800 0 800 1600

US Army Corps of Engineers
Galveston District

Rev.	Description	Date	By

Drawn by: E.S.R. | Date: X
Designed by: E.S.R. | Scales: AS SHOWN
Checked by: C.T. | Approved/Recommended:
Submitted by: ELIJIO GARZA JR. P.E. Area Engineer | DAVID B. CAMPBELL, P.E. Chief, Engineering Branch
Approved by: HARRY G. KOHLER, P.E. Chief, Engineering and Construction Division

U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

A/E FIRM/CONTRACTOR
3 LINES
PROVIDED

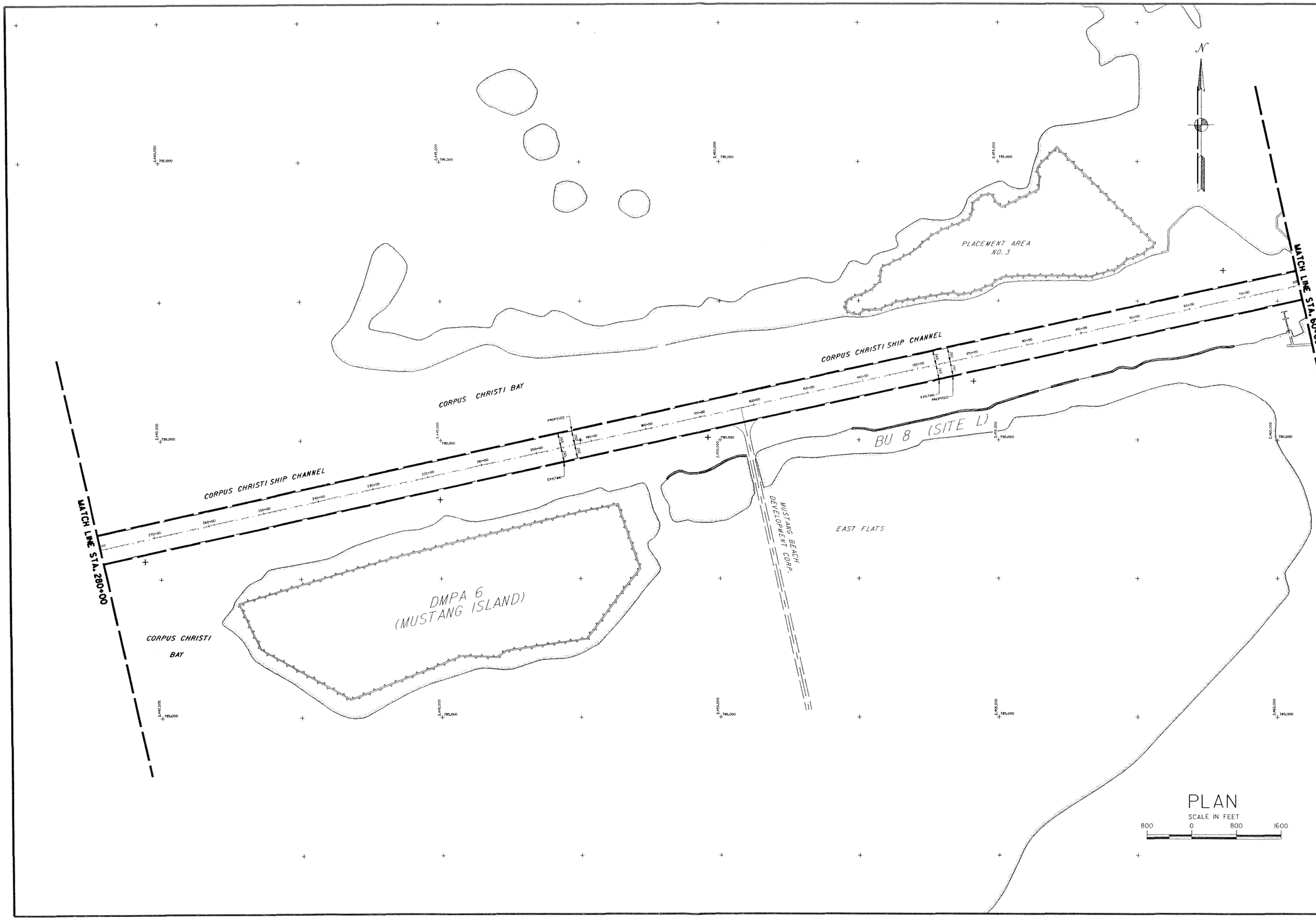
CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
ENTRANCE CHANNEL
TO VIOLA TURNING BASIN

DREDGING PLAN
STA. 280+00 TO STA. 500+00

Drawing No.:
C-6
Sheet of 91

File No.

Plate 7



US Army Corps of Engineers
Galveston District

No.	Date	By	Description

No.	Date	By	Description

No.	Date	By	Description

Drawn by: E.S.K. | Date: | Rev.: |
Designed by: E.S.R. | Scale: AS SHOWN |
Checked by: C.F. | Approved Recommended: DAVID B. CAMPBELL, P.E., Chief, Engineering Branch
Submitted by: ELIAS GARZA JR. P.E., Area Engineer
Approved by: HARRY O. KOHLER, P.E., Chief, Engineering and Construction Division

U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

A/E FIRM/CONTRACTOR
3 LINES
PROVIDED

CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
ENTRANCE CHANNEL
TO VIOLA TURNING BASIN
DREDGING PLAN
STA. 60+00 TO STA. 280+00

Drawing No.:
C-7
Sheet of 91

File No.

Plate 8

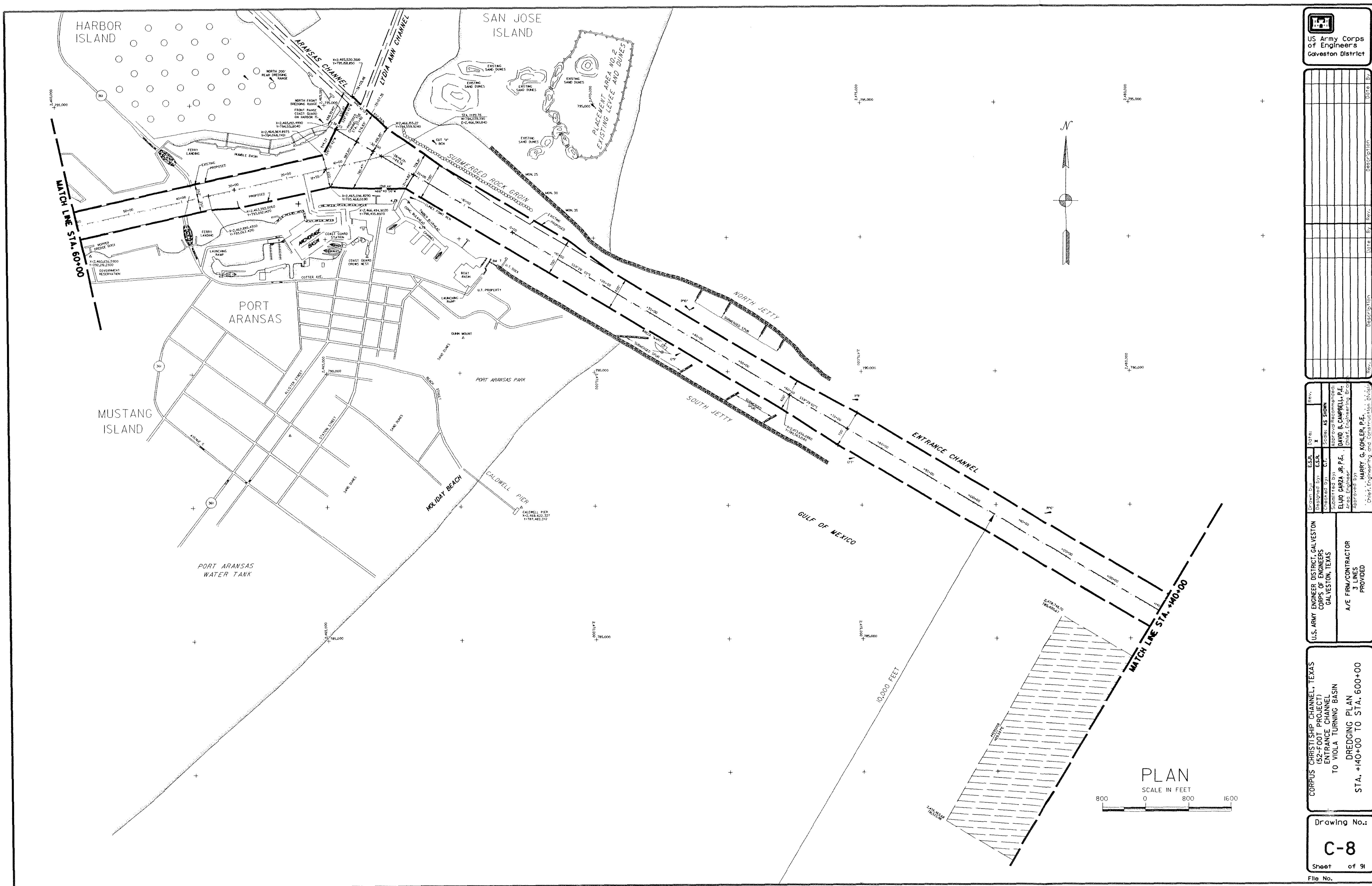

HARBOR ISLAND
SAN JOSE ISLAND
ARANSAS CHANNEL
LYDIA ANN CHANNEL
PLACEMENT AREA NO. 2 EXISTING LEVEE AND DUNES
SUBMERGED ROCK GROIN
NORTH JETTY
SOUTH JETTY
ENTRANCE CHANNEL
MATCH LINE STA. 60+00
MATCH LINE STA. +140+00
PORT ARANSAS
MUSTANG ISLAND
PORT ARANSAS PARK
HOLIDAY BEACH
CALDWELL PIER
GULF OF MEXICO
PORT ARANSAS WATER TANK
10,000 FEET
N
PLAN
SCALE IN FEET
800 0 800 1600
US Army Corps of Engineers
Galveston District
U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS
A/E FIRM/CONTRACTOR
3 LINES
PROVIDED
Drawn by: E.S.R.
Designed by: E.S.R.
Checked by: C.T.
Date: X
Scale: AS SHOWN
Submitted by: ELIJIO GARZA JR, P.E. Area Engineer
Approval Recommended: DAVID B. CAMPBELL, P.E. Chief, Engineering Branch
Approved by: HARRY G. KOHLER, P.E. Chief, Engineering and Construction Division
CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
ENTRANCE CHANNEL
TO VIOLA TURNING BASIN
DREDGING PLAN
STA. +140+00 TO STA. 600+00
Drawing No.:
C-8
Sheet of 91
File No.

Plate 9

MATCH LINE STA. +140+00

ENTRANCE CHANNEL

ENTRANCE CHANNEL

END OF ENTRANCE CHANNEL EXTENSION

GULF OF MEXICO

GULF OF MEXICO

BU 10
(NAVY HOMEPORT)
(SITE ZZ)

ODMPA 1

PLAN
SCALE IN FEET
800 0 800 1600

US Army Corps of Engineers
Galveston District

No.	Description	Date	By

Design by: E.S.R.
Date: X
Detailed by: E.S.R.
Scale: AS SHOWN
Checked by: C.T.
Recommended: DAVID B. CAMPBELL, P.E., Chief, Engineering Branch
Submitted by: ELMO GARZA, JR. P.E., Area Engineer
Approved by: HARRY G. KOHLER, P.E., Chief, Engineering and Construction Division

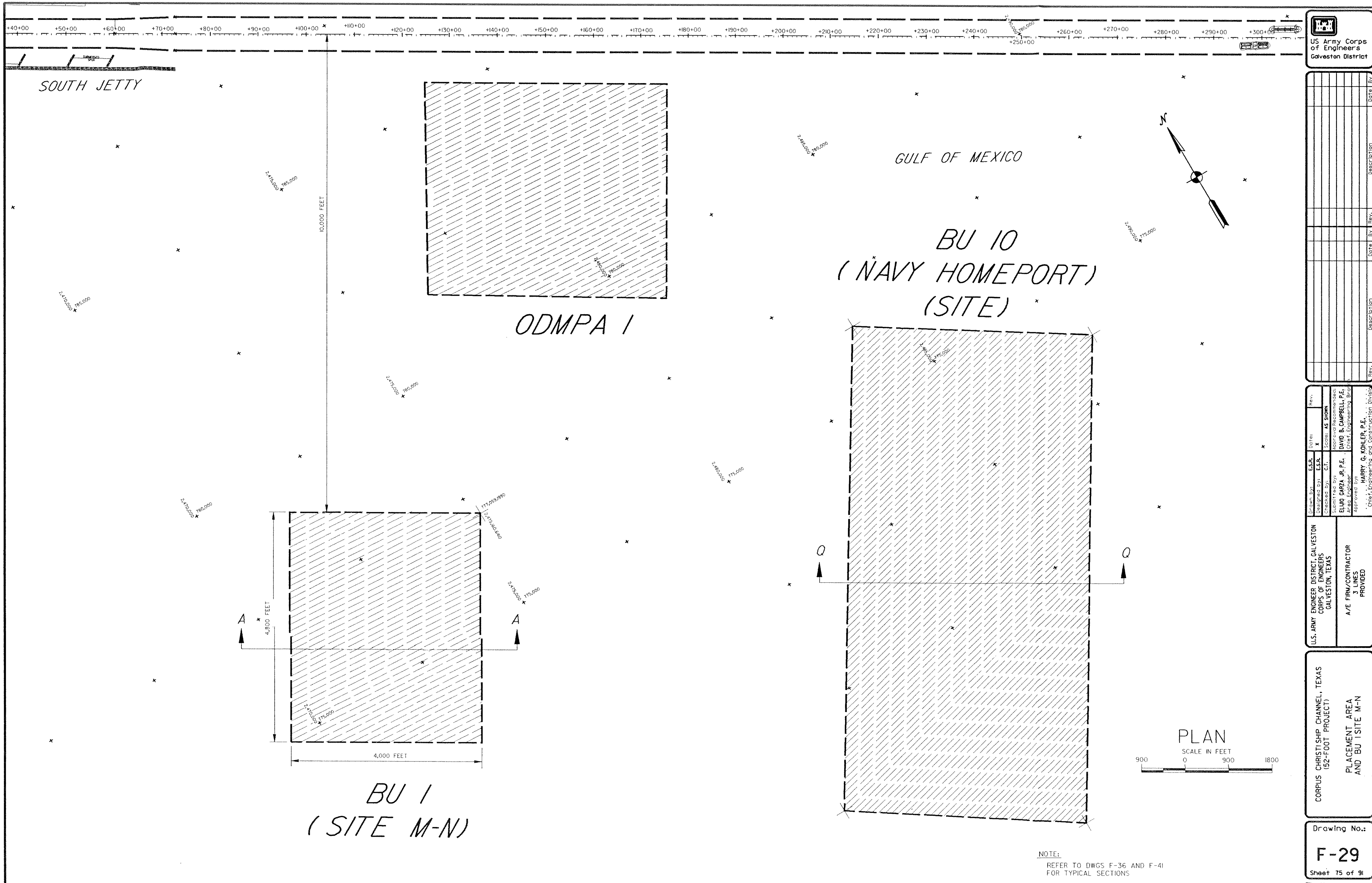
U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

A/E FIRM/CONTRACTOR
3 LINES
PROVIDED

CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
ENTRANCE CHANNEL
TO VIOLA TURNING BASIN
DREDGING PLAN
STA. +310+00 TO STA. +140+00

Drawing No.: C-9
Sheet of 91
File No.

Plate 10



SOUTH JETTY
GULF OF MEXICO
ODMPA I
BU 10
(NAVY HOMEPORT)
(SITE)
BU 1
(SITE M-N)
10,000 FEET
4,800 FEET
4,000 FEET
A
Q
PLAN
SCALE IN FEET
900 0 900 1800
NOTE:
REFER TO DWGS F-36 AND F-41
FOR TYPICAL SECTIONS
US Army Corps of Engineers
Galveston District
U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS
A/E FIRM/CONTRACTOR
3 LINES
PROVIDED
CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
PLACEMENT AREA
AND BU 1 SITE M-N
Drawing No.:
F-29
Sheet 75 of 91
File No.

Plate 11

PROPOSED AVAILABLE TRACT FOR PLACEMENT MATERIAL

PROPOSED PLACEMENT AREA

LOWER LIMIT OF DREDGING BEGIN STA. 309+51.47

UPPER LIMIT OF DREDGING END STA. 382+52

LIMIT OF PROPOSED NEW WORK DREDGING

PROPOSED EXTENSION TO LA QUINTA CHANNEL

TURNING BASIN

BU 6 (SITE G-H)

CORPUS CHRISTI BAY

PLAN

SCALE IN FEET

800 0 800 1600

US Army Corps of Engineers
Galveston District

Rev.	Description	Date	By

Drawn by:	E.S.R.	Date:	Rev.
Designed by:	E.S.R.	Scale: AS SHOWN	
Checked by:	C.T.	Approval Recommended: DAVID B. CAMPBELL, P.E. Chief, Engineering Branch	
Submitted by:	ELIJIO GARZA JR. P.E. Area Engineer		
Approved:	HARRY G. KOHLER, P.E. Chief, Engineering and Construction Division		

U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

A/E FIRM/CONTRACTOR
NAMES
PROVIDED

CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)
ENTRANCE CHANNEL
TO VIOLA TURNING BASIN
DREDGING PLAN
STA. 200+00 TO STA. 383+37.31
PROPOSED AVAILABLE TRACT
FOR PLACEMENT MATERIAL

Drawing No.:
C-10
Sheet of 91
File No.

Plate 12

KINNEY BAYOU

INGLESIDE

AVENUE B

PLACEMENT AREA NO.12

JEWEL FULTON CANAL

INGLESIDE COVE

CHANNEL TO LA QUINTA

CHANNEL TO LA QUINTA

CHANNEL TO LA QUINTA

DMPA 13
(LA QUINTA)

PLACEMENT AREA NO. II

TURNING
TURNING SIN

CORPUS CHRISTI BAY

PLAN
SCALE IN FEET
600 0 600 1200

NOTE:
REFER TO DWG. F-41 FOR TYPICAL SECTION R-R

US Army Corps of Engineers
Galveston District

Rev.	Description	Date	By

Drawn by: E.S.R.
Designed by: E.S.R.
Checked by: C.T.
Date:
Scale: AS SHOWN
Submitted by: ELIJIO GARZA JR. P.E.
Area Engineer
Approved: HARRY G. KOHLER, P.E.
Chief, Engineering and Construction Division

U.S. ARMY ENGINEER DISTRICT, GALVESTON
CORPS OF ENGINEERS
GALVESTON, TEXAS

A/E FIRM/CONTRACTOR
AS LISTED
PROVIDED

CORPUS CHRISTI SHIP CHANNEL, TEXAS
(52-FOOT PROJECT)

DMPA 13
(LA QUINTA)

Drawing No.:
F-45
Sheet 91 of 91

File No.

Plate 13